AMERICAN GAS ASSOCIATION MONTHLY

Vol. I No. 8

August 1919

IN THIS issue of the Association Monthly you will find, as matters of great importance to you, the special features which the 1919 Convention of the A. G. A. offers; suggestions for making an exhibition pay; notes on the work being done by our Industrial Engineering Service; and a reprint of the standards suggested for flexible tubing.

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AMERICAN GAS ASSOCIATION
MONTHLY

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Editor, ... Louis Stotz
Associate Editor. . T. M. Will

Vol. I AUGUST, 1919 No. 8

WITH THE EDITOR.

The Stronghold of Private Operation

Business of any kind, whether it be the business of feeding nations, of acquiring individual prosperity or accumulating national wealth, or just the business of living, requires a vast amount of machinery. Perhaps it is truer of Americans than of most other peoples, that we are not happy unless this machinery runs on oiled wheels. We grumble over the delays entailed by slow methods of obtaining hot water for our baths and we fret if telephone centrals do not answer the first click of our receivers. As a nation, we demand service and consider it our right.

We are not, however, interested in all the cogs and pulleys that make smooth running possible. Such detail, we aver, is the business of the man or the company that undertakes to serve us. We want results.

Since such is the case, when two or more systems for managing a utility compete for the privilege of serving us, we make our selection according to the results produced. We are less apt to ask about the underlying economic theory and more apt to inquire whether system A, or system B, will supply what we want without failure and through an organization that can be depended upon to take care of the smallest details without trouble to us.

We have just seen the impatience of Americans with the governmental operation of great utilities, because it did not show an improvement in service, whatever may have been the special circumstances that might have made it just as impossible for other managements to succeed.

Private operation of public utilities still holds sway in by far the largest percentage of our territory and just now it stands in favor with the general public. Wisdom among those who firmly believe in this system which has built up American industries and has cultivated that desire of ours for real service, will work to keep the public in a satisfied frame of mind. They realize two primary facts: *first,* that good service answers more forcefully than any other argument, the suggestions and appeals of the element that see profit or other advantage in public ownership and operation, and *second,* that good service will forestall such criticism and suggestion, and thus the utility management that is performing its work properly will not find itself in the ugly position of having to assume the defensive.

Build up public confidence in the integrity and the unfailing efficiency of your service and there is every human assurance that a question of other methods of management will not confront you. The gas company that renders a uniformly satisfactory gas service and makes the best in gas burning equipment available to its customers is doing more to eliminate the public ownership theory than any number of treatises could accomplish. Prove the soundness of private operation and initiative in public utilities now by rendering satisfactory service at every point.

Headquarters Service for Members

During the past month, the A. G. A. organization has moved from its temporary offices to its new quarters on the Auditorium floor of the building at 130 East 15th Street. Increased space, an enlarged clerical staff, a trunk line switchboard have been added to the general equipment, and now we take occasion cordially to invite all of our members to make the utmost possible use of our facilities. The visitor in New York will find us ready to serve him as an information bureau for points of interest in his business or pleasure trips about the city; we hold ourselves in readiness to readdress all mail forwarded to us for travelling members; we can provide suitable offices in which our members can conduct business interviews while in town. In short, it will be our pleasure to serve you in every possible way if you will but call on us and make these offices truly your headquarters when you visit New York or pass through the town.

AMERICAN GAS ASSOCIATION MONTHLY

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Extraordinary Features of A. G. A. Convention Not Confined to Program

OCTOBER 13-18, 1919

THE practical man who attends a convention called in the interest of his industry, never neglects the sessions at which committee reports and special addresses are presented; but he also knows that no convention worthy of the name can possibly confine its value to the items which appear on its formal program.

Readers of the A. G. A. MONTHLY have already been given a list of the special papers and reports which are being prepared for the first annual Convention and Exhibition of the American Gas Association and which will occupy, as at present planned, the greater part of the three days, Oct. 14, 15 and 16. Such men as Henry L. Doherty, Wm. H. Gartley, Chas. A. Munroe, F. H. Sisson of the Guaranty Trust Co.; N. C. Kingsbury of the American Telegraph and Telephone Co., dealing with subjects of utility securities, general gas company prosperity, public relationships and gas chemistry are their own recommendation to the gas fraternity.

Exhibition for Gas Accountants

Among the special features, however, which will be ready for the gas man at the Hotel Pennsylvania from Oct. 13 to 18, 1919, are the surprises of the manufacturers' exhibition at which even to date, with a few of the available spaces not yet assigned, the number of exhibitors compares well with that of any previous event of its kind.

The Accounting Section of the Association realizes to how great an extent the efficiency and prosperity of gas companies can be lowered by slow, inaccurate methods of bookkeeping. As a result of the Accounting Section's efforts and at its request, eight representative manufacturers of office labor saving devices are to exhibit and demonstrate their goods in a series of special booths so situated in a group that they can form the headquarters, or center of congregation, for gas accountants and bookkeepers who visit the Convention. Thus arranged and conveniently separated from the gas appliance exhibitions it will be

possible for all interested in the problems of the accounting department to follow the demonstrations and compare systems of office labor saving devices.

The Accounting Section is so in earnest concerning the needs of gas companies for up-to-the-minute office systems that it will occupy a special space at the Convention and hold itself in readiness to consult with A. G. A. members, to explain its special exhibits, and to make suggestions for the improvement and standardization of office practice. A paper by Mr. John L. Conover, of Newark, on "Office Labor Saving Devices," to be read at the Accounting Section's session, deserves special mention in this connection because the points which Mr. Conover has to make will be demonstrated from the platform as a part of his address. Mr. Conover's paper, while not officially offered as the recommendations of the A. G. A. committee of which he is chairman, will bring forth many suggestions worthy of the closest attention by gas managers and accountants.

Sight-Seers' Trip Through Hotel Pennsylvania

An article in the May issue of the A. G. A. MONTHLY gave such interesting facts about the gas equipment of the headquarters hotel that it has been found necessary, if our visitors and members are to be satisfied, to plan a number of personally conducted tours through the hotel.

The present plan contemplates the routing of two tours—one for those interested in gas equipment features only, and a second longer trip, which will take in a number of the special points of interest in a hotel that stands as the biggest in the world.

The tours will be scheduled to leave the lobby at stated hours, to suit the convenience of those in attendance at the Convention. The attendants at the A. G. A. information desk will be able to answer questions concerning hours and procedure. Those who have registered for one or the other tour, will be grouped into parties of fifteen or twenty.

To give our visitors an idea as to what they may expect to see, the longer tour has been outlined as follows:

Party assembles in lobby and ascends to roof.

Roof—inspection of kitchen, service rooms, gas installation, etc.

16th floor—grand suite.

10th floor—hospital.

The hospital of Hotel Pennsylvania is so elaborately equipped that its operating room vies with that of any hospital in the country.

2nd mezzanine floor—telephone room.

This room contains the largest private telephone exchange in the world. There are 23 positions and a force of 110 handles the scores of outside trunks and some 3,000 stations in the hotel.

1st mezzanine floor—beauty salon, library, offices, maids' dining room, trunk storage, carpenter and printing shops.

Main floor—dining rooms, service conveniences, office rack (a demonstration of a system which makes it possible to keep track of thousands of guests each hour of the day).

Basement—lunch and grill rooms, barber shop, main kitchen with gas equipment, meat and fish departments, vegetable, soup, pastry and ice cream rooms, food storage department, dish washing and drying apparatus, etc.

1st sub-basement—cafeteria for below-stairs help, wine storage vaults, bakery.

2nd sub-basement—laundry, engine room, ice plant.

Other Sight-Seeing Tours

We are able to announce that special arrangements are being made, through the courtesy of the hotel managements and the Consolidated Gas Co. of New York, whereby groups of those especially interested in hotel and restaurant equipment will be permitted to visit the kitchen departments of a number of New

York's biggest hotels, including the Biltmore and the Commodore, but recently opened. (See page 444).

Make Reservations Now

Once more we must urge all who expect to attend the Convention and Exhibition of Oct. 13-18 to make their hotel reservations now. All such business should be transacted directly with the hotel.

List of Applicants for Space at Exhibition

Metric Metal Works, Erie, Pa.
Reznor Mfg. Co., Mercer, Pa.
Geist Mfg. Co., Atlantic City, N. J.
Celite Products Co., New York, N. Y.
The Mead Gas Heater Co., Delawanna, N. J.
The Crandall Pettee Co., New York, N. Y.
The Safety Gas Lighter Co., Haverhill, Mass.
The Cleveland Heater Co., Cleveland, Ohio.
New Process Stove Co. Div. (Amer. S. C.), Cleveland, Ohio.
The C. M. Kemp Mfg. Co., Baltimore, Md.
Union Stove Works, New York, N. Y.
Young Brothers Co., Detroit, Mich.
Reliable Stove Co. Div. (Amer. S. C.), Cleveland, Ohio.
The Hoffman Heater Co., Lorain, Ohio.
James B. Clow & Sons, Chicago, Ill.
Weir Stove Co., Taunton, Mass.
National Tube Co., Pittsburgh, Pa.
Wm. Kane Mfg. Co., Philadelphia, Pa.
American Meter Co., New York, N. Y.
The Long-Landreth-Schneider Co., New Brunswick, N. J.
General Gas Light Co., New York. N. Y.; Kalamazoo, Mich.
Roberts & Mander Stove Co., Philadelphia, Pa.
Sprague Meter Co., Bridgeport, Conn.
Shapiro & Aronson, Inc., New York, N. Y.
The Peninsular Stove Co., Detroit, Mich.
Pittsburgh Water Heater Co., Pittsburgh, Pa.
The Surface Combustion Co., New York, N. Y.
The G. S. Blodgett Co., Inc., Burlington, Vt.
Griffin & Co., John J., Philadelphia, Pa.
Eclipse Gas Stove Co., Rockford, Ill.
Humphrey Co., Kalamazoo, Mich.
The Estate Stove Co., Hamilton, Ohio.
General Fire Extinguisher Co., Providence, R. I.
Superior Meter Co., Brooklyn, N. Y.
Geo. M. Clark & Co. Div. (Amer. S. C.), Chicago, Ill.
Ruud Mfg. Co., Pittsburgh, Pa.
The Bryant Heater & Mfg. Co., Cleveland, Ohio.
Steere Engineering Co., Detroit, Mich.
The Michigan Stove Co., Detroit, Mich.
The Union Steel Products Co., Ltd., Albion, Mich.
Erie Stove & Mfg. Co., Erie, Pa.
Meek Oven Mfg. Co., New York, N. Y.
General Gas Appliance Co., New York, N. Y.
Baltimore Gas Appl. & Mfg. Co., Baltimore, Md.
Ofeldt & Sons, F. W., Nyack, N. Y.
Detroit Stove Works, Detroit, Mich.
The Improved Appliance Co., Brooklyn, N. Y.
Rathbone Sard & Co., Albany, N. Y.; Aurora, Ill.
Welsbach Co., Gloucester, N. J.
William M. Crane Co., New York, N. Y.
Strause Gas Iron Co., Philadelphia, Pa.
Illinois Specialty Mfg. Co., Bloomington, Ill.
Wolff Gas Rad. Co., The A. H., New York, N. Y.
Lawson Manufacturing Co., Pittsburgh, Pa.
B. Ryan & Co., New York, N. Y.
Minneapolis Heat Regulator Co., Minneapolis, Minn.
Maxon-Premix Burner Co., Muncie, Ind.
The Bartlett-Hayward Co., Baltimore, Md.
Lindsey Light Co., Chicago, Ill.; New York, N. Y.
Equitable Meter Co., Pittsburgh, Pa.
General Briquetting Co., New York, N. Y.
The Roberts Brass Mfg. Co., Detroit, Mich.
The Lattimer Stevens Co., Columbus, Ohio.
The Eclipse Stove Co., Mansfield, Ohio.
The W. W. Barnes Co., East Orange, N. J.
Isbell-Porter Co., Newark, N. J.
Connelly Iron Sponge & Gov. Co., New York, N. Y.
United Lead Co., New York, N. Y.
H. Mueller Mfg. Co., New York, N. Y.; Decatur, Ill.
The Gas Industry, Buffalo, N. Y.
Abram Cox Stove Co., Philadelphia, Pa.
Gehnrich Indirect Heat Oven Co., Inc., Brooklyn, N. Y.
Cutler-Hammer Mfg. Co., Milwaukee, Wis.
The Gas Age, New York, N. Y.
Quick Meal Stove Co. Div. (Am. S. C.), St. Louis, Mo.
The Gas Record, Chicago, Ill.
Selas Co., New York, N. Y.
Dangler Stove Co. Div. (Am. S. C.), Cleveland, Ohio.
American Gas Engineering Journal, New York, N. Y.

Republic Flow Meters Co., Chicago, Ill.
Slattery & Bro., J. B., Brooklyn, N. Y.
Claus Automatic Gas Cock Co., Milwaukee, Wis.
Precision Instrument Co., Detroit, Mich.
A-B Stove Co., Battle Creek, Mich.
National Stove Co. Div. (Am. S. C.), Lorain, Ohio.
Milwaukee Gas Specialty Co., Milwaukee, Wis.
Comstock-Castle Stove Co., Quincy, Ill.
Perfect Combustion Co., Chicago, Ill.
Underwood Typewriter Co., Inc., New York, N. Y.
Elliott-Fisher Co., Harrisburg, Pa.
Kalamazoo Loose Leaf Binder Co., Kalamazoo, Mich.
Addressograph Co., Chicago, Ill.
The Rand Co., No. Tonawanda, N. Y.
Monroe Calculating Machine Co., New York, N. Y.
Library Bureau, Boston, Mass.
Burroughs Adding Machine Co., Detroit, Mich.
A. G. A. Accounting Section.
Bailey Meter Co., Cleveland, O.

We especially recommend the following article to EVERY EXHIBITOR at the A. G. A. Convention

The Show Exhibit---How to Make It Pay

And a Few Reasons Why Most of Them Don't

By AN AGENCY COPY WRITER

(Reprinted by courtesy of *Printer's Ink*, July 17, 1919.)

MANUFACTURERS and the men composing their advertising and sales departments do not seem to be overly enthusiastic about the value of exhibits at fairs, shows and expositions. They seem to regard such affairs more or less as hold-ups or at least as not very necessary evils.

Perhaps they are not very necessary; perhaps in some cases they are hold-ups. Whether or not they are has comparatively little to do with this article. I am merely going to record some thoughts that have been borne in upon me as I have attended the various shows and exhibitions that have been held in Madison Square Garden and elsewhere in New York during the last couple of years. Armed with plenty of complimentary tickets, I have had ample opportunity to "do" most of these shows thoroughly during their run.

I do not consider myself in any sense an authority on displays and exhibits, and when I say I believe I have discovered why exhibiting at shows is frequently unprofitable, I am expressing only my own personal opinion; but I shall leave it to you to judge whether or not that opinion is sound.

These, then, are the facts that have begun to force themselves upon me regarding these shows:

First—That generally there is some one exhibit that stands out very clearly in the visitor's mind as he walks out, and one or two others that seem to have made fairly strong impressions.

Second—That these two or three exhibits seem to owe their effectiveness (as expressed in terms of mental impression and remembrance) to one of two things:

1. Great novelty—news value, we might call it.

2. The graphic presentation of some one single fact or point about the product or service exhibited.

It is, of course, comparatively simple to achieve effectiveness with an article or service that is in itself *News*. It is also quite easy to *spoil* the effectiveness of that same exhibit, and it has been my observation that such exhibits *are* frequently spoiled.

But the real difficulty is to make an effective and profitable exhibit for a product or business that is common, that has no particular novelty or "news" connected with it. It is not always possible to arrange a really startling exhibit for such a product or business, but I believe a definitely interesting and rememberable exhibit can be built for *any* business or product.

How?

One Thing at a Time is More Easily Remembered.

Well, as I have studied these various shows at the "Garden," and also other shows of various kinds, I have become impressed with one big, outstanding fact: That the really effective exhibits, the ones I have remembered the next day and the next week, and which I found other people were noticing and remembering and talking about, have been built on the same principle that the most successful advertisements are built on. *They stick to one point or fact or feature and drive it home.*

The human mind works just the same at a show or exposition as it does on a trip through the advertising section of a magazine. It accumulates dozens of vague impressions and unrelated pictures, but only the ideas that are worked out simply and graphically and stand by themselves are retained as vivid pictures.

We have long realized that in preparing our printed advertising, but what happens when we are confronted with the problem of working up a show exhibit? Well, here is a fair sample:

Office of advertising manager of the Good Luck Gas Stove Company. Assistant advertising manager turns to his chief: "How about the Boston Food Fair in October? Do we exhibit as usual?

Advertising manager: Yes; H. E. B. says we'll show. Personally I think it's money almost thrown away. Glad you spoke of it, though. We ought to be getting ready. Better have Miller look over the nickel-trimmed show models and see that they're all right. Speak to Grant about having the factory hustle through one of the new D-Series combinations—that'll be a good show number—and see if the new Kompact Kitchenette model is going to be ready in time. Then get out the show signs—and you'd better get that new bird's-eye view of the plant enlarged and framed and put it across the back of the booth. And throw in a set of those new lithographed car cards and—"

"How about having a set of our new full-page ads framed and hung around in the bare spaces on the walls?"

"All right; good idea. And pack up a good supply of catalogues and about a million of those 'Good Luck Baking' booklets. We'll give those to the kids instead of catalogues this year. I think you'd better plan to be there as much as you can during the Show, and plan to take Robbins and Walters. They know enough about the line to answer questions—if there are any. Generally there isn't much excitement, though."

Many Will Recognize This Type of Exhibit

You can easily picture the Good Luck Gas Stove Company's exhibit at the Food

Fair. A row of spick-and-span gas ranges with much nickel plate; a large sign overhead bearing the company's name and address and the trade-mark lettering, "Good Luck" (in red) at the front of the booth; a large framed picture of the factory against the back wall, hung well up, with a dozen framed car cards underneath it and a greatly enlarged reproduction of a testimonial letter from the woman who bakes the property bread for "*Loaves of Love*" playing on Broadway and now in its 110th performance. On the side walls a miscellaneous collection of the company's recent magazine advertisements, topped in each case by a large hand-lettered edition of the Good Luck slogan, *"Your money back if it doesn't bake to suit you!"*

On an oak table is a huge pile of the "Good Luck Baking" booklets, which either Robbins or Walters piles up neatly every little while, there being nothing much else to do, except to keep the kids from turning on the gas on the only stove in the exhibit that is connected up. A few more piles of the booklets on the tops of the various stoves and some leaflets bearing a fac-simile reproduction of the letter from the *Loaves of Love* lady, and you have the complete picture, excepting for the large catalogues which have been by agreement placed in the oven of the all-nickel model out of sight of the kids. And, of course, of evenings from 7.30 on Miss Masterson, from the Cooking School, gives a demonstration of Good Luck Bread baking.

And past this exhibit walks the endless procession of mildly curious men, women and children, unconsciously, but nevertheless definitely, looking for some peg of interest on which to hang their attention.

In the afternoon that motherly looking woman with the two little girls stops a minute and says: "Oh, look at the nickel-plated gas stove. Ain't it pretty?" And the kids say, "Oh! yeh!" And they pass on. But they have spoken for the whole "afternoon crowd."

In the evening when Miss Masterson is baking there is quite a group around her as she bakes in the 218-A Model, but there are such long waits between demonstrations that the interest lags and people glance up, see the inevitable picture of the factory, the framed ads, the proofs of the car-cards, *the everything in general and nothing in particular*— and pass on. And they do *not* talk about the Good Luck display on the way home on the car, or at the breakfast-table next morning. It is nothing in their busy lives.

And that is what, in my humble opinion, is the matter with the majority of show exhibits. *They are not effective because they say everything in general and nothing in particular.*

Years ago we fellows who write advertising found out that to make really successful advertisements we had to have some dominating selling appeal—some *idea* that we could make definite and graphic. And we found that it pulled in proportion to its definiteness and graphicness. And as I have attended fairs and shows of various kinds, I have discovered—it came to me quite unconsciously—that the exhibits that I found the crowds around and that I heard people talking of on all sides—were constructed on this same principle. They were built around one central idea, and nothing extraneous was allowed to enter to confuse the eye and mind. They had a definite message to get across, and they got it across and stopped.

They did not try to sell the factory and nickel-plate and car-cards and framed advertisements. *They sold a clean-cut idea.*

And as a humble writer of advertisements I believe the Good Luck Gas Stove Company could do the same. How?

A Single-Track Exhibit

Well, for instance, suppose the big selling point that has sold so many Good Luck Gas Stoves is, *good luck in baking.* Why not build the whole exhibit around those four words, with not another thing to distract the attention, not even an all-nickel model?

Why not make that exhibit say *good luck in baking* so definitely and so graphically that people would take it seriously—would *have* to take it seriously? It could be done. Such things are being done successfully in advertising every day.

Magazine advertisers have long since learned to leave out the picture of the factory, unless the factory is the one big selling point of the campaign. And they have learned not to clutter up their advertisements with all sorts of random thoughts about the business. They stick to the big selling point and make it as interesting and as graphic as possible.

As for the possibility of making ordinary, every-day, uninteresting and uninspiring things graphic in an exhibit, ever since I saw a certain very simple exhibit demonstrating that a million people a year die of consumption draw gaping crowds to a window display of the Charity Organization Society of New York, I have assured myself that *anything* can be made graphic. I had frequently seen statistics of the yearly death toll from consumption, and various charts illustrating these alarming statistics, but I never sensed what consumption actually meant to the world until I had edged my way up through the crowd and stood looking at this display, a simple little sign, with a single electric-light bulb mounted at the top, reading,

Every Time
This Light
Goes Out
Someone in the
Civilized World
Dies From
Consumption
2 Every Minute
120 Every Hour
2,880 Every Day
1,000,000 Every Year.

There we stood, a crowd of us, watching that light blink every half minute. It was the only thing in the window, and it certainly got its message across. It was nine or ten years ago that I saw that sign, but I have never forgotten it, and probably I never shall.

I hold that if an abstract statistic can be demonstrated so forcefully, a manufacturer's selling message surely can be put across in a way that will stick.

But, just as advertisers had to learn that a jumble of rambling thoughts about their product or business didn't make effective advertisements, just so they will have to get an entirely new slant on their exhibit at shows and fairs before they will have any chance to pay. It isn't merely a matter or rearranging the models or materials; what is needed is a complete revolution of attitude toward exhibits.

It is too easy to fall back on "show models," cross-sections, enlarged photographs and exhibits of the product in the various stages of manufacture—none of which belong for a minute unless they have a very direct and necessary bearing on the "big idea" that you are trying to get across, whether it is "Double the Wear Where the Wear Comes" or "The Varnish That Won't Turn White" or "Just Add Hot Water and Serve" or "Good Luck in Baking."

And as for "literature," I'd vote, in most cases, not to have any in sight at

all. I'd try to make my exhibit so definitely interesting and graphic that people would carry away a picture and the outstanding facts *in their minds*—not in their *hands,* to be dropped in the hall on the way out or taken home for the children to tear up.

"Yes, but exhibits aren't worth all that trouble," said a manufacturer to whom I was expressing these ideas recently. Whereupon I demonstrated to him that to build a graphic and intensely interesting display around his own chief selling point would take less time and trouble than to build the sort of an exhibit that he was sending out.

That's the best part of it—effective displays are nearly always simple to arrange. The hardest thing about it is to *leave* them simple, not add this and that and the other picture or model or sign. And, having built a simple display for one show, it is very hard to *keep* it simple—to prevent it from accumulating pictures and models and signs from time to time as it is shown on different occasions.

But if you really want to build an effective exhibit: Keep it simple! Keep it simple! *Keep It Simple!*

American Gas Association Pledges Support to National Thrift Campaign

THE following resolution was adopted by the Executive Board of the American Gas Association, in a meeting assembled on July 24, 1919, in New York City:

"WHEREAS, the Treasury Department of the United States has inaugurated a national movement to induce greater thrift through the sale of saving stamps and otherwise, in an effort to increase the practice of consistent savings and national thrift, and

"WHEREAS, it is acknowledged that thrift is beneficial to the people at large and necessary to promote lasting prosperity.

"RESOLVED, that the American Gas Association pledges its support and co-operation to the Secretary of the Treasury, in the conduct of the campaign inaugurated under his direction."

A copy of the resolution was forwarded to Mr. Roy G. Blakely, Vice-Director of the Savings Division of the War Loan Organization, Treasury Department and was ordered published in the American Gas Association Monthly, as a public expression of the official stand which the Association has taken toward the Treasury Department's national movement for education in thrift.

War Gardens a Thrift Measure

The Association has recently received from Charles Lathrop Pack, President of the National War Garden Commission, three very valuable booklets on war gardening, home drying and canning of fruits and vegetables, and home storage of foods. These "victory" editions insist that "The needs of peace demand the increased production of food in America's Victory Gardens" and we are sure that they will prove a valuable contribution in national thrift education. Gas companies desiring copies of these booklets for their files or for general distribution should write direct to the Commission, Maryland Building, Washington, D. C.

A Graphic Method of Cost Analysis

G. I. VINCENT, Syracuse, N. Y.

ALL gas utilities keep costs and the methods may vary from a daily or even hourly study in large plants to a dependence on the general books (usually closed monthly) in the smaller plants. While the value of a very close cost system is not questioned, it would generally be found to be prohibitively expensive in any but the larger utilities.

Costs taken from the general books loose much of their value because they are not available for study and comparison until some time after the close of the month in which the costs have accrued.

The graphic system here described is so simple and inexpensive that it can be used in any situation regardless of size. There are, of course, a number of different systems of accounting used by gas utilities and the various accounts bear different names throughout the country. However, it is generally understood that the production accounts cover all the expenditures required for the manufacture of gas and the up-keep and maintenance of a gas plant. The distribution accounts cover the distribution operations and may or may not include main and service, and appliance installations. No attempt will be made to describe all different accounts but a few concrete examples will be given to illustrate the system.

The accounts which justify the most study or, in other words, the accounts which will show the most gratifying reductions under intensive and scientific study, may involve labor or material or both. Some accounts are largely or exclusively labor and others largely or exclusively material. In some cases, as for example the manufacturing materials accounts, the possible reductions are in the quantities used per thousand. The costs of the materials are usually beyond the control of the immediate operator. His energy would, therefore, be devoted to reducing the per thousand quantities of these materials. Other accounts, such as production labor, are exclusively labor and here the data available should indicate the possibilities and progress in reducing the labor cost per thousand.

In the distribution accounts, the costs are made up generally of both labor and material but the material costs are fairly definitely fixed and reductions in them will usually be made by improvement in the design of installations and connections. It should not be inferred that the material costs should not be studied but the necessity for continuous and intensive study of material costs of the different distribution accounts is not apparent.

It is assumed that all well operated plants estimate their operating costs for each year. Each operator wants to know how he stands with relation to his estimate; what progress he is making in returning to it if he has been running over it, or what further improvements he can show if he has been running on it. All this information can, of course, be taken from columns of figures but it can be shown much more clearly, and certainly much more rapidly, by graphic study.

The system here described is drawn from one in actual use, where it is possible for the superintendent of production or the superintendent of distribution to tell at a glance not only for one but for all of his accounts, all the following details:

1. The estimated cost for the account for the year.

2. The cost for the same account for the previous year.

3. The monthly totals and accumulated total for the account for the year to date.

4. The monthly totals and accumulated total for the entire previous year.

5. The estimated unit cost or quantity of material or both per thousand for each account.

6. The corresponding figure for the previous year.

7. The monthly or weekly unit cost or quantity or both for the current year.

8. The corresponding figure or figures for the entire previous year.

Including totals and send-out curves, over fifty accounts are used and for convenience these are plotted on electric load curve sheets, which are mounted in groups of six on swinging leaf display boards 36 inches square.

The send-out curves are plotted weekly because certain production accounts are kept weekly and, further, by plotting a number of consecutive years of weekly send-outs on the same sheet, it is possible to predict with reasonable accuracy the send-out for any week during the year.

Two colors of ink are used where two years are plotted. Where more than two years are plotted, as in the send-out curves, as many different colors can be used as are available.

Two accounts only will be described, both taken from the production division. It is unnecessary to go further because these two fully illustrate the principle. The figures given are not taken from the actual accounts of any plant. The two accounts are known under the New York State System of Accounts as "Boiler Fuel" and "Boiler House Labor."

This is a material account and efforts would be largely devoted to reducing the quantity used per thousand cubic feet of gas made. Fig. 1 is the graphic study of this account. To avoid confusion,

FIG. I

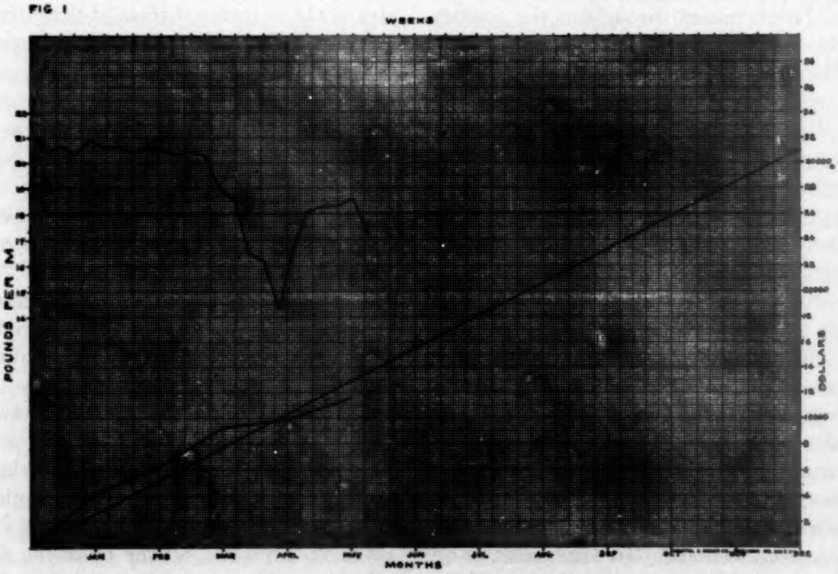


Fig. 1.—Graphic Study of "Boiler Fuel."

FIG 2

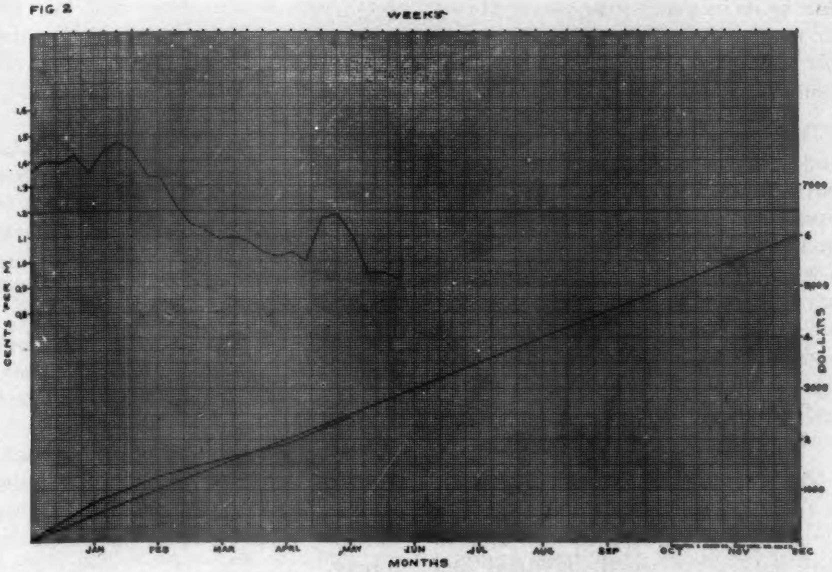


Fig. 2.—Graphic Study of "Boiler House Labor."

only the current year is plotted but it may be understood that the previous year would have been plotted on the same sheet with ink of a different color.

The bottom of the sheet is divided into months, and the top into weeks. The left hand vertical column represents amounts of fuel used, per thousand cubic feet of gas made, and the right hand vertical column measures dollars.

The total cost of the account for the year is estimated before the beginning of the year from the estimated cost per ton of coal, amount of gas and pounds of coal per thousand cubic feet of gas. This figure being determined as $31,000 a diagonal line is drawn from the lower left hand corner of the sheet to the 31,000 on the right hand vertical column. Plotting the total costs for the account for each month as taken from the general books shows the amount of monthly and accumulated costs to date.

The quantity of boiler fuel per thousand being estimated at 18 pounds, the horizontal line is drawn from the 18-pound mark on the left-hand vertical column. Each week the actual boiler fuel used per thousand of gas made is plotted. It may be satisfactory to plot these amounts monthly only, but as a general rule the more intensive the study, the shorter must be the time interval.

It may be that the divisions on the load curve paper will not correspond exactly to the calendar week as compared with the calendar month but this does not affect the study, nor is it necessary to have the per thousand figures absolutely accurate. Slide rule calculations are entirely satisfactory.

The procedure is exactly the same as in the boiler fuel account. The annual estimate determined from the estimated send-out, probable wages, and a study of the labor, including that required for expected improvement, is plotted as a total on the right hand vertical column and the diagonal line drawn which repre-

sents by its increments the estimated cost per month of this account. The actual cost taken from the books is plotted monthly.

The total of the account from the weekly pay roll summary is divided (by the slide rule) by the gas made, which gives the cost in cents per thousand for the week. If the pay rolls are made up bi-weekly then the top horizontal line may be divided into periods representing two weeks instead of one. As this can be done immediately, in fact, before the pay roll is paid, the operator has an immediate check on the progress of his work in improving the efficiency.

The cost of maintaining this system is so trivial as to be practically negligible as an operating expense. A woman clerk makes the weekly divisions and plots them on the sheets and this requires about an hour per week. For the monthly accounts the plotting only is required, as it is usual to keep the monthly accounts in any case.

The eight specific items which will be shown by the graphic study as described are really only a small part of what is actually exhibited. The thousand and one variables which come into the operating can, if they are of any moment, be noted immediately on the charts.

The effect of labor-saving devices will be noticeable at once. Among the many other interesting things it has been found that a large repair in the production division which, presumably, would only affect the repairing account, frequently has a marked effect on a number of other accounts, which a graphic study indicates at once.

Water Gas Oil Efficiency on a B. T. U. Basis

(Several articles have been received as a result of an investigation by the A. G. A. Chemical Committee on the subject of the best formula for calculating the British thermal unit efficiency of oil in carbureted water gas manufacture. Formula and curves submitted by E. H. Earnshaw appear on page 382 of our July number and further contributions will be published from time to time.)—EDITOR.

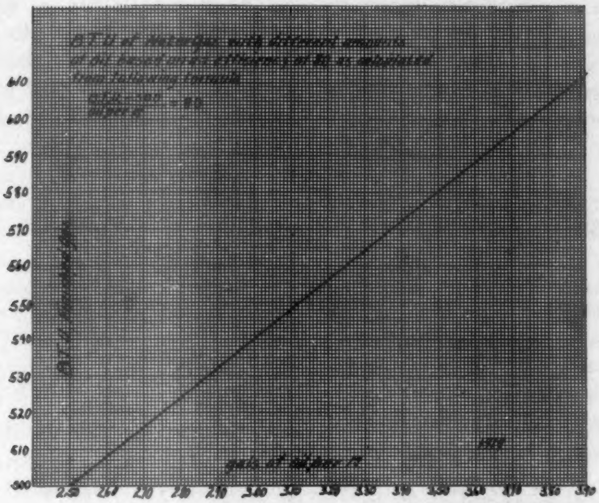
THE illuminating power of carbureted water gas is entirely due to the hydrocarbons of the gas oil set free by the cracking process, since the "blue gas" or straight water gas is non-illuminous. On a candlepower basis, the oil efficiency is expressed as "candles" per gallon and obtained by dividing the candlepower by the gallons of oil used per thousand. Such a factor is definite and clearly shows whether the oil is cracked so as to produce the maximum candlepower.

The figure and oil efficiency on a British thermal unit basis is an entirely different problem since the British thermal unit of the "blue gas" is 50 per cent. or more of the total British thermal unit of the finished gas. To determine accurately the British thermal unit efficiency of the oil, the following factors should be known:

1. B. t. u. of "blue gas."
2. B. t. u. of finished gas.
3. Per cent. of blue gas in finished gas.
4. Per cent. of oil gas in finished gas.

With these four factors it would be possible accurately to figure out the British thermal unit imparted to the gas per gallon of oil used. It is impossible, however, accurately to determine factors 1, 3 and 4.

Several methods have been proposed



for figuring the oil efficiency on a British thermal unit basis, a few of which are as follows:

1. British thermal unit of finished gas divided by the gallons of oil used per thousand.
2. British thermal unit of finished gas minus 300 divided by the gallons of oil per thousand.
3. Assume that a gallon of oil makes 65 cubic feet of oil gas and that the British thermal unit of the "blue gas" is 300. Then calculate the cubic feet of oil gas made, which, subtracted from 1,000, gives the cubic feet of "blue gas." Multiply the cubic feet of "blue gas" by 300 and subtract the product from the total British thermal unit per thousand of carbureted gas. The difference will represent the British thermal unit from the oil gas, which, divided by the gallons of oil used per thousand, will give the British thermal unit imparted to the gas per gallon of oil.
4. Determine the percentages of oil gas and "blue gas" from the complete analysis of the carbureted gas by arranging the constituents under two groups constituting the oil gas and the "blue gas" as follows:

Oil Gas.
- Hydrocarbons.
- Methane—1.5 per cent.

Blue Gas.
- Carbon dioxide.
- Carbon monoxide.
- Hydrogen.
- Oxygen.
- Nitrogen.
- 1.5 per cent. methane.

The British thermal unit of the "blue gas" is calculated from the analysis and the rest of the calculation is the same as in No. 3 above.

Method No. 4 requires a complete analysis of the gas which is something that is not made in the majority of gas plants.

The factor given by Method No. 1 varies with the amount of oil used per thousand.

Method No. 3 gives a fairly definite factor but the calculations are rather tedious and, therefore, much more chance is offered for error to creep in.

Method No. 2 gives a satisfactory result for gas ranging between 500 and 600 British thermal units. The calculation is very simple and when used, a factor of 80 or better is indicative of good operating results.

The attached chart is figured on the basis of a factor of 80 with Method No. 2 and shows what British thermal unit might be expected with any given amount of oil ranging from 2.5 gallons per thousand to 3.90.

Rochester's Chemical Laboratory Proves Its Value

C. H. STONE

WHILE a consciousness of the importance of the chemist's work has been greatly stimulated in the gas industry because of the war, there is undoubtedly much of an educational nature necessary before gas managers generally will realize in full the value of the chemist in the development of their plants.

The word "generally" is used advisedly, for some companies have already shown their faith in chemistry as an aid to dividends, and Rochester is to be numbered among these pioneers, not as starting a laboratory, but as going into it whole-heartedly.

The Rochester laboratory is situated at the gas works on the east side of the Genesee river. Two large rooms are excellently equipped with benches, hoods, glassware, chemicals, etc. At each worker's desk are attachments which enable him to use gas, hot and cold water, steam, compressed air and electricity. An inner room is provided for photometric work, and two calorimeter cabinets are fully equipped for the determination of heating values. Electric ovens and furnaces are largely used in the drying and igniting of precipitates, and in determinations of volatile and ash in coals. A separate room is set apart for the crushing, grinding and sampling processes; this is equipped with two electric ovens, a two-section ball mill, a new Braun disc pulverizer, a riffle, a sampling table and a closet for samples. A small balance room and a library open out of the main rooms, the library being well furnished with magazines and a small but choice collection of chemical books.

It is generally supposed that the work of the laboratory is largely routine. Such a condition is doubtless necessary to a certain extent but the amount of routine can be greatly abridged if the "man higher up" will see that the chemist is not loaded down with a mass of analyses, unless in themselves and rarely consulted by those at whose request they are made. Rochester laboratory has, of course, its routine tests to make, such as British thermal unit gas analyses, candlepower, analyses of still liquor, light oils, coals, etc. We have, however, urged the various heads of departments to bring their special problems to us, and in this way have received a constantly increasing amount of varied and interesting work to do, which is not only greatly enjoyed by the laboratory force, but is of real value to the departments.

The laboratory is also frequently called upon for advice or for scientific information, and in either case, time or money is saved to the applicant. For instance, the vice-president wanted information as to the flame temperatures of various gases, some of which had to be calculated. He called up the laboratory, and in a short time the figures were in his hands. He could undoubtedly have

looked this up for himself, and made the necessary calculations, but the references were in the chemical library and his time was worth at least five times that of a laboratory man, so that this one little job paid for a chemist's time for one week.

Another case occurred the other day when the head of a department called up to tell us that the paint on a large steel penstock was in bad condition and to ask our advice as to how it should be treated. We examined the penstock (one of our men being a paint specialist), discovered the cause of the poor service rendered by the original paint and made recommendations as to its removal and replacement, which, if carried out, will render this large and valuable piece of property safe for years to come.

Again, one of the electric stations notified us that the cooling coil in one of their voltage regulators was choked. It is a brass coil, and if spoiled, its removal and replacement would have meant a very expensive job. The laboratory sent a man to the station, secured a sample of the material which was causing the stoppage, analyzed it in an hour, ordered the proper chemicals and had them delivered, and saw that they were employed in the proper strength and for a safe length of time. The result was eminently satisfactory to all concerned. The transformer was restored to service in short order and without any injury. There were no guesses made as to the proper acid to use, or the strength thereof, and consequently no time was lost and no damage done. No one will deny that the laboratory saved the company both time and money in this case, and with regard to the money, the saving may have been anywhere from $20.00 to the several hundred dollars which would have been the cost had the coil been wrecked, or even eaten through.

Numerous other instances could be cited of the value of this kind of work, but enough has been said to emphasize the point.

With regard to the routine work, naturally most of it centers around the gas plant, and for the benefit of those who still believe the value of a chemist's work to be mythical, one or two instances will be given where the routine work of the laboratory has been the means of saving money in the operation of the gas works.

We furnish a mixed gas which, by law, must have 585 B. t. u. gross per cubic foot. At the time of this instance, the plant was sending out 4,000,000 cubic feet of coal gas and 2,000,000 of carbureted water gas per day, and as the former was always below 585, the deficiency in heating value had to be made up by the water gas. The coal gas works were of a new type, recently installed and apparently running well. The routine gas analysis showed 17 per cent. nitrogen. At first it was thought the chemist was wrong, but after getting practically the same per cent. for several days, the trouble was located and remedied. The British thermal unit of the coal gas over an 8-day period averaged 553. This meant that the British thermal units in the water gas had to be maintained at 649 to make a mixed gas of legal requirements. Our oil efficiency per gallon per thousand runs about 96 B. t. u. With these figures it is easy to calculate that we were using 9,000 gallons of oil per day or 4.5 per thousand. Since the trouble was remedied the coal gas has run about 575 B. t. u., which, based on the above figures, means a saving of 1,200 gallons of oil per day, or, at prices then prevailing, $72.00 per day, which, for the 8 days, amounts to $576. This loss might have continued for much more than 8 days but for the daily analysis and British thermal unit tests.

We give one brief instance concerning the coal analyses. Just before placing the yearly contracts, two companies, A and B, submitted a number of car samples for test. There was little to choose between them as to appearance, price or delivery. A gave somewhat more gas than B, however, and without analysis might have been considered a much better coal. The laboratory results showed that A had 17.7 per cent. ash and 8 per cent. sulphur, while B had 6.4 per cent. ash and 0.95 per cent. sulphur. The company uses a minimum of 175,000 tons a year, partly at the gas works and partly at the electric plant. The difference in ash between the two coals would amount to 19,775 tons per year, and assuming a cost in the retort or boiler of $5.00 per ton, and disregarding all handling of ashes, poorer coke, extra labor in handling, etc., this would mean a difference to the Company of $98,875 per year. Moreover, the higher sulphur in A would greatly increase the purification costs, (if, indeed, the gas could be purified at all), cause injury to the boilers, spoil the coke, and altogether increase the above loss by many thousand dollars.

In summer, naphthalene becomes a routine test. It is doubtful if anyone can put a monetary value on naphthalene control, but on the other hand no one will dispute that it has such a value, if he has, like the writer, seen every available man in a company working day and night to give gas to frantic consumers, or if he has seen the main from meter to holder plugged so tight that one could not even smell gas at the holder end.

It is an especial pleasure to turn to some of the less frequent but perhaps more interesting ways in which the laboratory is now called on to serve the various departments. The Transportation Department has sent in lubricating oils, both fresh and after use, and in some cases analysis has shown the used oils, even after a few days of service, to have so low a flash point and viscosity as to be not only useless but dangerous.

The Commercial Department recently sent in a stove polish which behaved fairly well until slightly warmed. Then it would ignite at the least provocation and give off an intensely disagreeable, fish-like odor.

For the electric stations a large aluminum turbine ring which had given out after a short use, was tested, to ascertain whether the per cent. of zinc was greater than specifications.

The Purchasing Department furnished an asbestos listing which it had been besieged to buy, and which it was solemnly assured contained only 5 per cent. cotton. The laboratory managed to lose 34 per cent. of this "asbestos" on ignition, and the purchase was not made.

The Construction Department had been having a great deal of trouble with a certain brand of rivet and none at all with another kind. They were sent to the laboratory to determine the reason for this.

The Safety Department had complaints of the tincture of iodine furnished in its first aid cabinets. The laboratory found that the strength was much greater than it should be and gave figures on the proper amount of alcohol to add.

The Line Department, by the aid of the laboratory, was enabled to choose between two cable compounds. Great claims were made for each, but viscosity, chilling and rupture tests told the story.

It had become a sort of venerated custom for any department to put in a requisition for the paint which it required, specifying whatever kind appealed for the moment to the fancy of the department head. The general manager realized the weakness of this policy and determined to break it up. The

laboratory was called in and given samples of paints that had been purchased from high grade firms. These were not only analyzed, but given a practical painter's test. The work is still in progress and so cannot be reported fully. It may be interesting to note, however, that one white paint which was held in the highest esteem by one department, and which would have been purchased in large amounts at a very satisfactory price (to the manufacturer) was found to contain 91 per cent. of inert material consisting of 63 per cent. barium sulphate and 18 per cent. magnesium silicate, 8 per cent. magnesium oxide, 6 per cent. iron and alumina, etc. The total lead in all forms calculated as carbonate and sulphate was less than 1 per cent. and the zinc oxide only 4 per cent.

In addition to the above, to occupy any time that might hang heavy, a number of researches have been started. These for the most part deal with possible economies at the gas works, and if any one of the four tests now under way is successfully completed it will mean many thousands of dollars saved to the company.

In conclusion, it is hoped that enough has been said to prove that the laboratory is more than self-supporting. Figures could have been evolved for the special analyses before mentioned, to show the probable saving of each to the company; they were only omitted in order to abridge this article.

Consumers Meters Committee in Chicago

THE meeting of the Consumers Meters Committee at the Hotel Sherman, Chicago, Friday, July 11, was notable for many reasons.

It was the Committee's first meeting held in the West pursuant to the plan of gathering the Committee together in different cities upon invitation from the local gas companies; and in attendance, enthusiasm, and work accomplished, it proved easily the most successful of the year.

The following gas men were present and earnestly attacked the problem of formulating a final report from the data and tests submitted: Geo. Lane, co-chairman; W. A. Castor, Philadelphia; J. D. von Maur, St. Louis; E. J. Bartel, Brooklyn; D. A. Powell, Milwaukee; J. A. Clark, Jr., Newark; Frank Hellen, Rochester; O. F. Felix, Pittsburgh; W. Griffin Gribbel, Philadelphia, and H. W. Hartman, New York.

An exhaustive discussion of the details contained in the Committee's program was necessary to co-ordinate all the recommendations submitted. The members, however, borrowing Chicago's motto "I will," in their effort to reach an agreement, proceeded to break another record by remaining in session from 10 A. M. to 8.30 P. M., with but a brief adjournment for lunch.

The meeting first drew up a tentative schedule for proof testing meters and agreed upon definite recommendations covering the following points:

Check and open column test on meters removed from service. (A report on over 10,000 meters proved on check and open column tests and instructions for making tests will be attached to the Committee's report).

Slow motion or small flame test.

Limits of error.

Reporting proofs.

Capping meters upon removal from service.

Period for holding meter in proving room before test.

Use of oil on top of water in meter provers.

Accuracy of provers.

A proposed new schedule of check test caps, recommending that the standard rate of flow through check openings be based on meter capacity instead of light size, is also under consideration by the Committee.

Standardization of meter sizes and nomenclature was discussed at length as also the objects to be obtained and results accomplished in spraying meters. Reports on experiments conducted in spraying were submitted, one company reporting good progress in stopping slow motion leaks through this practice. After a full consideration it was decided, however, that further experiment and study should be devoted to this question before definite recommendations were submitted.

Before adjournment several members expressed their gratification at the spirit of enthusiasm and co-operation attending the Chicago meeting and the complete facilities afforded by the local company for the Committee's work.

RECENT ARTICLES IN CHEMICAL PRESS OF INTEREST TO GAS MEN

Contributed by Sub-Committee on Abstracts* of the Chemical Committee

MANUFACTURING PLANT OF THE PROVIDENCE GAS CO., PART II. By Walter M. Russell, *Chem. and Met. Eng.*, Vol. 21, No. 2, 88-94 (July 15, 1919). Description of the installation and operation of the new water gas and producer gas plants at Sassafras Point—water and producer gas machinery and apparatus, measuring and recording instruments. Part III will describe in detail the new Koppers combination gas ovens. (F. N. Sperr, Jr.)

A NEW GOVERNOR FOR CLOSE PRESSURE REGULATION OF GAS EXHAUSTERS AND BOOSTERS. *Chem. and Met. Eng.*, Vol. 21, No. 2, p. 99-100 (July 15, 1919). A thorough description of the construction and operation of the new pressure governor made by P. H. and F. M. Roots Co., of Connersville, Ind. The governor is of the cut-off type. (F. N. Sperr, Jr.)

EXTRACTING AMMONIA FROM GASES. British Patent 121,754, 1918. By E. L. Pease, *Chem. and Met. Eng.*, Vol. 21, No. 2, p. 102-3 (July 15, 1919). Ammonia is extracted from hot gases; for example, from furnace gases or gas producers, by a solution of a salt, such as calcium chloride or zinc chloride, possessing the properties of forming a double compound with ammonia. A diagram and description of the apparatus for carrying out the process are included. (F. N. Sperr, Jr.)

GAS FLOW METERS FOR SMALL RATES OF FLOW. By A. F. Benton, *Journal of Industrial and Engineering Chemistry*, Vol. 2, p. 623 (July, 1919). Describes usual tvpes of meters and takes advantage of frictional resistance to flow. Gives theoretical discussion and experimental results of the resistance tube meter. (E. J. Murphy.)

CYANOGEN TESTING IN COAL GAS. By Howard W. Callahan, *The Chemist-Analyst*, No. 28, p. 18 (Jan., 1916). A detailed method giving the reactions involved for testing cyanogen in coal gas. (E. J. Murphy.)

* Abstractors' names appear in brackets following each item.

Baltimore Gives Publicity to Public Relations

GOOD PUBLIC SERVICE

The third of a series of 13 advertisements concerning Baltimore's gas and electric service

True Function—Service, Not Commodities

The true function of The Gas and Electric Company is not to supply gas and electricity as commodities, but to render to Baltimore, gas and electric service.

The Company's service goes into practically every home, plant and institution in the city—not delivering fifty cubic feet of gas here and fifty kilowatt hours of electricity there—but cooking your meals, heating your rooms, lighting your home, cleaning your house, washing your clothes, turning the wheels of your factory; providing heat where heat is needed, light where light is needed, power when, where and in what quantity you want it.

It is the Company's desire and constant endeavor, to provide for every customer a service that is complete and satisfactory in every detail.

If your service is not satisfactory, tell us, so we may remedy conditions and fulfill our obligations to you.

The Gas & Electric Co.

THE above cut shows one of a series of thirteen advertisements which the Consolidated Gas, Electric Light and Power Company of Baltimore are at present running in local papers. The first of their ads, entitled, "The Human Factor in Public Service," reprints a statement which is attached to every blank of application for a position with the Company. The "statement" sums up the qualities—loyalty, industry, courtesy, vision, etc. which such service demands from the employee, and the advantages which the Company offers its workers—educational helps, permanent work, pensions, sick and death benefits, recreation, share of profits, etc. Ad No. 2 emphasizes the Company's recognition of the fact that "Public Service is a Public Trust."

Another piece of copy tells the reader that the Company has a General Service Department the function of which is to help all customers to get the largest amount of the best service possible in their particular situations.

The telephone is a source of great help only when it is properly used. To tell the people, as the Baltimore ads do, how to use its exchange, is bound to lessen that feeling of unreasonable irritation which comes if one finds himself tangled in a series of "hold the wire, please" responses.

It is the avowed purpose of the series to strengthen the feeling of good-will between the Baltimore Gas and Electric Company and its public, by telling the latter frankly, the Company's own aims and ambitions and problems in rendering a perfect public service to its community.

Wilmington Gas Company Forging Ahead in Industrial Business

INDUSTRIAL FUEL ENGINEERING SERVICE

THE Wilmington (Del.) Gas Company may be counted among those companies which have adopted the "Let's Go" and "Get Busy" slogans, as applied to their commercial activities.

Mr. W. A. Ehlers, Industrial Fuel Engineer of the Association's headquarters staff, has recently completed a five week engagement at Wilmington and reports a very active and healthy condition in industrial business. This is Mr. Ehler's second engagement with the company, and it was very encouraging to find, among numerous new industrial accounts, four large ones which have been taken on since his first visit in 1916, when two of these were thoroughly investigated and a complete report presented showing the advantages of gas over fuel oil.

Singeing and Drying Cloth

In the manufacture of cotton cloth, the company has a single customer that uses from 12,000 to 15,000 cubic feet of gas per hour. The heating applications in this plant are unique and interesting.

The finishing of cotton cloth requires the burning off of all fuzz and loose thread ends. The most satisfactory method for accomplishing this has proved to be a combination operation for scraping, singeing and ironing the surface of the material.

The cloth is passed over "red hot" copper plates which have been heated to approximately 1,500° F. by burners applied at both ends. The plates, which are 60 inches long and 1¼ inches thick, are arched to a radius of 7 inches. Four machines, each having three such plates, are used.

By the usual method, the cloth is run over the first two plates and then around a roller so that the under side is brought into contact with the third plate. Several lengths of one grade of cloth are sewed together and passed over the plates at from 150 to 400 yards per minute, according to the texture of the material.

Before adopting gas to heat the singeing plates, the manufacturer used about five gallons of Mexican fuel oil per hour per plate. He is now using approximately 550 cubic feet of gas per hour per plate. In the same factory there is an apparatus consisting of a row of open flame burners, over which cloth of a certain grade is passed, in such close contact with the burners that the fuzz and loose threads are thus burned off. Needless to say that in both of these types of singeing operation the steadiness and accurate control of the burners make gas an ideal fuel.

Drying Cloth

In practically all cloth making operations, drying plays an important part at some point in the process. Here again, gas is used to great advantage. A long piece of wet cloth is placed on two rollers which are separated so that a tightly stretched section of the goods is continuously passing from one roller to the other. This stretched area of wet cloth passes over the end of a metal tube which is designed to blow hot air through the fabric. The tube begins with a funnel into which an open flame gas burner is inserted. The force of the flame draws a large volume of air into the funnel and this, being heated, passes through the tube and blows through the cloth, thus completely drying it in a minimum of time.

A large amount of gas is also used to heat the rolls of calendering machines, by means of which certain grades of material are "ironed," or given the proper surface finish.

Ore Roasting

Another of Wilmington's big industrial consumers uses gas for an ore roasting operation. In other plants of the same company, fuel oil is used for this operation and a comparison of the two fuels has led to an expression of opinion by the managers that gas gives the more satisfactory results.

A pulverized ore is delivered to four continuous conveyors, each about 3 feet wide and bedded 8 or 9 inches thick. The ore is carried under a special burner which extends the full width of the conveyor and directs its flame downward into the product. Each burner consumes about 850 cubic feet of gas per hour. There is also an additional equipment of twelve large burners that are used intermittently to start combustion in several ore roasting ovens.

Gas from a high pressure main is delivered to this manufacturing plant, reduced to 10 pounds per square inch, metered, and piped to the burners, where the proper amount of air is induced by the high pressure gas. The burners are, therefore, easily and efficiently operated by means of a single valve.

Soft Metal Melting

In a Wilmington factory where large quantities of rubber hose are made, gas has replaced oil for the heating of three 500-pound soft metal melting pots from which the molten lead is poured almost continuously.

The gas is raised to a pressure of 10 pounds per square inch by means of a water-cooled compressor and admitted to the combustion chamber through a single valve control. The temperature of the molten lead, a very particular point, is regulated by thermo-valves.

Gas in Ship Building Operations

Since the beginning of the war, Wilmington has taken a leading part in the building of ships.' The management of one of the companies engaged in the enterprise was not long in recognizing the economic advantages of gas for fuel purposes, and as a result, installed the following equipment:

One furnace 3 feet 10 inches wide by 52 feet 6 inches long, for heating angles for bending.

One furnace 6 feet 6 inches wide by 36 feet 0 inches long, for heating steel plates for bending.

One rivet heater for supplying rivets to a bull machine riveter.

The company has just placed an order for the following gas-heated core ovens for a new foundry, all of which will be thermostatically controlled:

One core oven 20 feet wide by 20 feet long by 18 feet high.

Two core ovens 20 feet wide by 20 feet

long by 11 feet high.

Six core ovens 4 feet wide by 6 feet long by 6 feet high.

Mr. Ehlers is now arranging for the installation of gas-fired brass melting furnace equipment which will have a daily melting capacity of 3,000 pounds of brass. Negotiations are also well under way for the introduction of gas in another brass foundry in Wilmington where ten No. 70 crucible type, forced draft, pit furnaces, fired with coal and coke, are now being used. The management of the plant did not decide to use gas until after Mr. Ehlers had shown comparative costs per unit of metal melted, and their consulting engineer had made a statement in which he expressed his belief that gas fuel would be far superior to oil, coal or coke.

In addition to these larger problems, miscellaneous appliance sales aggregating a thousand dollars were closed. These included a steam boiler for heating leather pressing machinery, several metal treating furnaces, and welding and cutting torches.

The new opportunities for industrial gas which were found by Mr. Ehlers, are so numerous and attractive that the Association's Industrial Engineer will make a number of return visits to Wilmington during the summer and fall for the purpose of closing contracts for this and other business which may develop in the meantime.

Repeat Orders from New York Hotel Management on Gas Equipment

THE first order for goods of any kind may be termed an experiment, a trial, a gamble, even. It is significant of one thing only—the salesman's ability, whereas the second and third orders are the testimony that counts in reckoning the value of the goods. To state the case picturesquely, it has been said, "A good salesman can dip a banana in brown paint and sell it as a frankfurter—but he could not sell the same man twice."

The hotel salesmen of the Consolidated Gas Co. of New York are of the opinion that the best argument with which to approach the manager who still uses coal in his hotel or restaurant kitchens, is the fact that some competitive establishment, the business acumen of whose management he knows very well, has taken to gas and found it a saver of time and money.

These salesmen interested the management of the Hotel Ansonia in gas equipment and replaced coal burning appliances with gas. Actual use for several months proved the case and now gas is also the kitchen fuel for the Belmont, the Biltmore, the Manhattan, and the Commodore Hotels. These, together with the Ansonia and the Murray Hill, are all operated by one management and the fact which has kept the Murray Hill from revising its equipment in favor of gas is explained when one knows that this old New York hotel is marked for demolition to permit the erection of a new and much larger structure on its present site.

Selling gas to these five big hotels meant in each case convincing the kitchen operating force, chef, steward, and engineer, that gas could give better results than coal; but it was notable that after the Ansonia installation, the management was always ready to give the final word which closed the order.

The Commodore Equipment

To indicate the size of the installations required in this line of New York hotels, the following brief descriptions are given by Mr. R. V. Howes of the Utilization Department of the Consolidated Gas Co. of New York.

The Commodore is one of the newest hotels in New York and one of the largest in the world. Both the Commodore and the Pennsylvania, which it closely rivals, were erected during the war, and to a large extent by the same construction firms. The Commodore, designed by Warren and Wetmore, conforms in general style to the structures around the Grand Central Terminal. It has 2,000 rooms and has been doing a capacity business ever since its opening.

The kitchens of the Commodore were planned by Walter J. Buzzini, kitchen equipment dealer and specialist. All the equipment was furnished by him and installed under his direction.

In the main kitchen there are thirteen sections of 45-26P Garland range in addition to four salamanders, one eight-compartment broiler, and one 36-inch special broiler and griddle, all by Buzzini. Six coal sections were also set but these are not being used.

In the banquet hall ten sections of 45-26 Garland hotel ranges were installed. It has been found that this equipment was not quite up to the demands and twelve special roasting ovens, to be placed over the ranges, are now being manufactured by the William M. Crane Co., under the supervision of the gas company.

In the helps' kitchen there were set two special sections of gas range built by Buzzini.

In the grill there are four sections of 45-26 Garland and one four-section broiler by Buzzini, with a two-section toaster in the service pantry.

In a preparation kitchen off the main kitchen there are two sections of 45-26 Garland and one Buzzini salamander.

The Standard Gas Light Co. supplies this hotel through two 6-inch services connected to an 8-inch header. There are four 250-light, old-style meters which throw only a $^2/_{10}$ drop. The outlets are two 5-inch lines from an 8-inch header.

Belmont Bake Oven Converted to Gas

The Belmont is a comparatively old hotel, but constant renovations and additions have kept it in the front ranks as to both equipment and appointments.

The kitchen formerly had three batteries of coal ranges, one 26 feet long, one 20 feet long, and one 8 feet long. The 26-foot battery was replaced with seven sections of 45-26P Garland range, with a 1-foot dead plate between each two sections. The 20-foot battery gave place to six sections of 45-26P Garland range with a 7-inch dead plate between each two sections and instead of the 8-foot battery, three sections of 45-26P Garland range are in use.

The high shelves formerly in use over the coal ranges were retained, and four 16-26C Garland salamanders are fitted to the high shelf.

There was also one 18-36 Garland toaster installed in the service pantry.

The hotel already had in service a 11-foot 6-inch battery of special gas broilers and since these were satisfactory, they were not altered, nor was a four-compartment gas roasting oven in good condition, changed.

The bake oven was an internally fired Dutch oven of brick construction. This oven was converted to gas by installing two No. 5 Maxon-Premix burners with a refractory bed of special firebrick balls.

The banquet hall kitchen of the hotel is comparatively small, having only 10 feet of special gas range and one broiler.

Manhattan Figures Show Saving with Gas

The Manhattan, one of the really celebrated hotels of New York, is directly west of the Grand Central Station, on the corner of Madison Avenue, from 42nd to 43rd Street. This hotel runs to capacity all of the time. It would be quite impossible to feed any more people at regular hours as its dining rooms are always completely filled.

No place could give a fairer comparison between the services of gas and of coal. The hotel is doing the same business to-day that it did a year ago, and a year before that. Capacity business is the kitchen and dining room routine.

In the Manhattan, gas ranges have replaced coal ranges; gas burners in the bake ovens have replaced coal burners, and the management figures show a saving of $249.00 the first month over the figure for coal range operation as shown by a 6 months' average. To-day the management says that there is a saving of $10.00 per day over coal, and the whole arrangement is working perfectly satisfactorily. The main battery in the main kitchen formerly consisted of 32 feet of coal range with eight fires. This was replaced with nine 45-26P Garland hotel ranges with a 9-inch dead plate between each two sections.

The secondary battery consisted of an 8-foot coal section, which was replaced with two sections of Garland 45-26P.

The Manhattan is the home of the Transportation Club, a luncheon club which has its separate kitchen. This was equipped with 8 feet of coal stove, which was replaced with three sections of Garland range.

The hotel, which has 615 rooms, has a seating capacity of 900. The kitchen occupies 9,300 square feet. The average number of meals served per month is 90,000.

It is interesting to find that the cost of charcoal for the hotel averaged $241.00 per month for 6 months; maintenance coal equipment, $93.00; cartage, ashes, etc., $86.00; while the actual coal cost only $289.00 per month. These expenses were in addition to the salary, $70.00 per month, and the meals, $45.00 per month, of a fireman, whose services are no longer required.

It is obvious, of course, that gas fuel costs can be compared with coal costs only when the items which accompany coal are also figured.

The Biltmore

The Biltmore, one of the finest of New York's large hotels, had 60 feet of coal range in the main kitchen, which were replaced with nineteen sections of Garland 45-26P range. The broilers were already gas-fired.

In the banquet hall kitchen on the eighteenth floor, there were 20 feet of coal range, 22 feet of old style gas range, and two charcoal broilers. These were removed and replaced by eight sections of 45-26P Garland range, three sections of 94-26 Garland range, two 524 Garland broilers and one 16-30C Garland salamander. The house gas line to the eighteenth floor was too small to carry the additional equipment and a new line was carried up through an elevator shaft.

The Biltmore has 974 rooms and the regular seating capacity of its dining rooms is 3,824. The average day finds the hotel serving 4,500 meals to its guests and 2,500 meals to its 1,600 employees. The New York Mutual Gas Light Co. supplies this hotel and made the installation.

Special notice is called to the fact that the kitchens of all these hotels will be freely shown to any gas man who so desires, at Convention time or to suit his own convenience.

Tone of Window Displays Sells Product to Women

"I REALLY enjoy paying my gas bill!" Perhaps only a woman would put it just that way, but since women do the retail buying for over 75 per cent. of our population, it behooves the man with something to sell to understand her paradoxes.

In this particular case, the paying of the gas bill was the lady's excuse for visiting the gas company's offices, otherwise quite beyond her ordinary route, and the visit was a real pleasure because the gas company maintained a display room and a series of display windows that never failed to give her new ideas or new reasons for pride in the domestic gas equipment which she possessed.

The gas company manager who does not advertise through display windows that rival the best examples of that art in his town, is either ignorant of, or he is ignoring, the psychology of the largest class of his buyers.

Every woman wants the distinction of having the very best and newest there is, whether it be for her personal adornment or the furnishing of her house. The tests she applies are not necessarily scientific. She will often judge by appearances, by popularity and by the fact that a social leader uses this article or it can be obtained only at a shop which everybody knows caters to the "best people" in town. So strong is this desire to keep up with the "best" that the poor girl, compelled by consideration of price to buy the cheapest of materials, will search for the merchant who manages to impart to his shop and his wares an appearance of richness, quality and exquisiteness that suggest the fashionable store.

Since this is a fact, recognized by successful merchants the country over, why should the gas company manager fail to make good use of it? Not one, but practically every merchant in his town is training the women—the buyers of that town— to judge the quality and desirability of his goods and the perfection of his service by the display rooms and windows which he maintains.

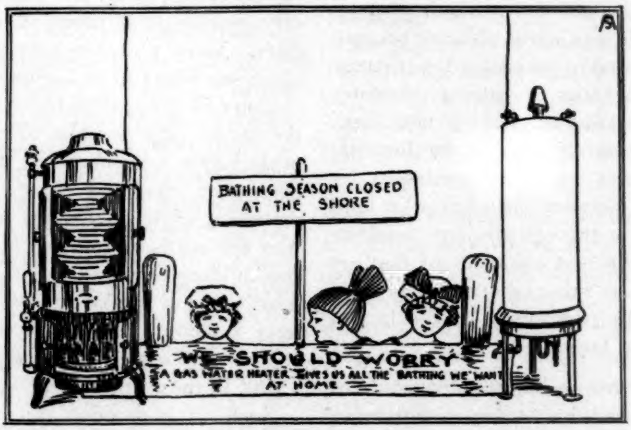
The gas company furnishes a necessary service, it is true, at economical rates. Many a woman uses gas, not because she wants to or has any feeling of pleasure in the matter but only because she has to. But gas also offers "extras" in the way of enamel ranges, dining room equipment, time and labor saving devices that might delight any woman. All that she needs to quicken her desire is the building up of an impression in her mind that gas service and gas appliances have a definite connection with beauty, leisure and charm, such as are ordinarily found in the homes of the very rich.

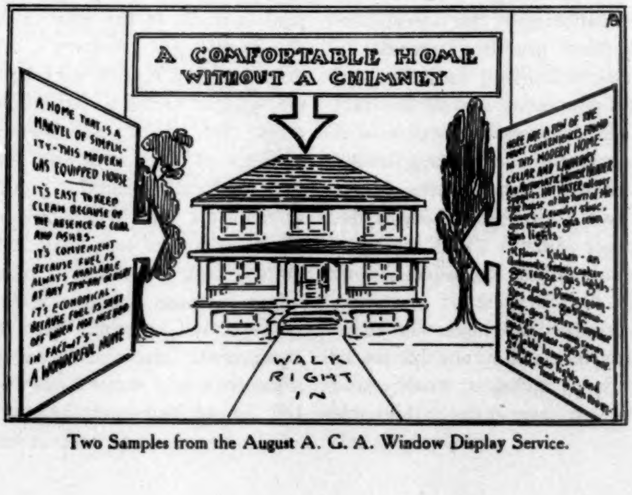
Such an impression can be created much more easily and quickly if the appeal is made to the eye. Let a woman see in the gas company's display windows, enamel ranges, nickel-plated toasters, all-gas kitchens, art-studio kitchenettes, and let her see them always in settings of such richness and artistry that they call to mind a picture of their appropriate use in a home of wealth. Then, whatever her financial and social status, that woman will be proud and happy because she uses gas. Her discontent will be with her present gas equipment. She will do her best to buy a gas iron or a water heater and she will tell her friends of her conveniences while she strives to keep at least one gas-

heated domestic device ahead of her neighbors.

Not so the woman to whom gas service is merely a humdrum necessity for lights and range. The complaint, "They never have anything new to offer," is as fatal to a business as the opposite fact is vitalizing. It is by proper window displays that the gas company can stimulate the woman's imagination to see those same lights and range in a more up-to-the-minute setting, or offer her a new appliance for a new use of gas. "This gas heater was wonderfully displayed in those wonderful windows of the gas company. I know everybody will want one, and I have one now!"

Gas window displays can tell facts about service and equipment—they can show the goods; but this is not all. They can create desire, for they can surround the idea of gas service and gas appliances with such a glamour and tone, that women will feel that somehow, just to use gas, is a mark of social standing—as is the possession of a seven-passenger car.





Two Samples from the August A. G. A. Window Display Service.

Accident Prevention in the Gas Industry

WHILE soldering a meter case, some hot metal splashed into a workman's eye, causing a blister. Goggles would have prevented this accident.

A workman, while pulling hot coke from a retort with a hoe, dislocated his shoulder. The safest way is the easiest way. This workman probably stood in an awkward position, thinking it the easier way to work.

Two men were shoveling coke into a machine when one of them struck the other over the eye with the handle of his shovel. Another example of careless practice, which might have resulted in the loss of an eye.

In taking down a pipe line, a workman rested his ladder against the pipe he was disconnecting. Pipe, ladder and man fell to the ground. Simply a case of "nobody home." This workman never stopped to think what he was doing.

A workman was tightening a nut on a stoking machine in a retort house when the wrench slipped and caught his finger between it and an angle iron. He failed to report the injury until two days later. If more care had been taken to make sure that the wrench fitted the nut and was placed correctly, this accident would not have happened. Failure to report the accident promptly might have resulted seriously.

While emptying the contents of an acid-soda fire extinguisher, it exploded and injured the workman on the chin. Taking off the cap of the extinguisher and removing the bottle of acid before emptying the soda container would have prevented this accident.

A workman was standing on a scaffold when a board broke, causing him to fall to the ground. More care in seeing that the scaffold was safe would have enabled the workman to work during the entire month he was disabled.

A pinch bar lying overhead fell and struck a workman on the head. Tools should not be left where they are liable to fall on anyone working below.

In trying to open the dump on the bottom of a coal car, a workman jumped on the wrench, which slipped and caused him to fall to the ground, injuring his back. Good judgment would have saved this man from a painful injury.

J. B. DOUGLAS,
Accident Prevention Committee.

Pension Systems

Does your company use a pension system? If so, please send us an outline of your plan for our files. Your name in connection with the plan will be carefully safeguarded, if you so desire.

One of our company members has asked for such information and we believe that an exchange of pension plans and data through the Association will be of benefit to all members.

If your company pensions its employees, let us hear from you at once.

Michigan Convention

The Michigan Gas Association will hold its annual meeting on September 17 and 18, at Hotel Statler, Detroit, Michigan. An attractive program of papers and entertainment has been provided. Mr. W. W. Barnes, Secretary of the Manufacturers Section, will be the official representative of the A. G. A. at this meeting.

How's Business?

THE following taken from a trade letter sent out by the Secretary of the Hydraulic Society, and reprinted with his kind permission, contains much of interest, we believe, to members of the A. G. A.

Let's list the items that go to make bad or good business, to see where we stand.

DEBITS.

Coal and copper mining almost at a standstill.

Building pretty nearly as bad.

Steel industry running at 60 per cent. capacity.

Railroads losing money at the rate of $800,000,000 a year and another rate increase imminent.

Heavy taxation—high cost of living—high labor costs—industrial unrest—unemployment.

Hand to mouth buying because of high costs and fear of price declines—fear of deflation.

Import embargoes by England, France and Italy.

Premium on the dollar in those countries as a further brake on our export trade.

Likewise the difficulty of financing such trade.

CREDITS.

Retail buying the heaviest ever known—good business in automobiles, rubber and leather goods, and many lines of luxuries—all indicating free buying and an ample buying power on the part of the people.

Crops—last report, 100.5 per cent., a point never before reached. The wheat crop alone will give the farmer a buying power of nearly 2½ billions; corn, over 4 billions, to say nothing of hay, oats, cotton, etc. Were nothing else in sight, this would in normal times be considered the basis for an exceedingly prosperous year.

Wartime repression of demand to be satisfied—depleted markets to be restocked—war's destruction to be made good.

Building rapidly reviving—over 2 billions needed to catch up with the country's needs.

The financing of the railroad's requirements being arranged—200,000 tons steel rails now being contracted for.

Road building proceeding in many States—aided by an $100,000,000 appropriation from the Federal Government.

Smallest number of failures in history.

Unemployment declining—Bolshevism under control.

Italy, Roumania, Greece, Poland, Czecho-Slovaka, Finland, Belgium and France now have buyers here, arranging for credits running up into many millions.

Foreign competition will not be an important factor for sometime because costs in Europe just now are higher than they are in this country on most manufactured articles.

WHAT'S THE ANSWER?

Except, perhaps, temporarily or in isolated cases, don't the credits seem to outweigh the debits? Then, why the doubt, the hesitation?

Because many people are still waiting for a price slump For months the economists have preached deflation, but did you notice that Dun's Index figure of averaged commodity prices on May 1, was only 4 points below May 1, 1918, and *2.4 points higher than it was two months before?*

Why rising instead of falling prices? Because apparently the credits for prosperity and good business are pulling stronger than the debits—prosperity is coming and prosperity is always accompanied by rising prices (see Babson's).

With the demand so great that food prices are rising instead of falling, labor cannot suffer a reduction—wages are going up in many sections of the country.

(Continued on page 474.)

Flexible Tubing Tests

THE Committee on Standardization of Gas Appliance Specifications of the National Commercial Gas Association presented in its report for 1916 (see page 399 PROCEEDINGS N.C.G.A., 1916) a set of tentative specifications for flexible gas tubing together with proposed standard designs for rubber hose ends and metal hose end nozzles.

The specifications and standards presented at that time were offered for criticism and discussion before adoption, and because of the merging of the National Commercial Gas Association, no final action was ever taken on the report of the Committee.

Subsequently, the Bureau of Standards actively took up the investigation of this subject for the purpose of arriving at specifications which would be acceptable to the gas industry and the results of this investigation were published in the *Gas Record* of June 25, 1919. They are reprinted in this issue of the MONTHLY in order that they may be brought before the full membership of the American Gas Association and in the hope that the criticism and suggestions which the Bureau of Standards desires before recommending their adoption, will be forthcoming.

BUREAU OF STANDARDS REPORT

R. S. McBRIDE and W. M. BERRY

The importance of having good grades of flexible tubing for gas has been obvious from the considerable number of accidents resulting in loss of life and to property which have been caused by the poor quality and the improper or careless use of the material commonly sold for this purpose. Recognizing the importance of the subject, the American Gas Institute and the National Commercial Gas Association appointed committees, which, working in co-operation, drafted a tentative set of specifications and presented them at the 1916 meetings of these societies. About the same time the Bureau of Standards began some work along the same lines, and this developed into the investigation reported in this paper. The tests were made on about three dozen samples of flexible tubing, some of which were sent in by manufacturers, and others purchased in various retail stores. Many of the samples from the manufacturers were obtained through the courtesy of Oscar H. Fogg, then with the Consolidated Gas Co., New York, N.Y. We desire to express here our appreciation of Mr. Fogg's assistance in this work.

The preliminary work on these tubings was completed about two years ago, and the results were submitted in preliminary form to the manufacturers and gas company representatives, but numerous war activities interrupted the work altogether, and only within recent months has final attention been given to the matter. Additional experimental data and a few changes in conclusions have been included as the result of the information and comments received from those to whom the preliminary report was submitted.

Before final adoption of specifications either by the gas associations or the Bureau of Standards for the National Gas Safety Code, it is anticipated that co-operation in this work will enable the bureau and the associations to formulate mutually satisfactory standards so that the specifications which are finally adopted may be identical. As a step toward this highly desirable end, this report of tests has been prepared and now is presented to bring out the further discussion which is essential before more definite recommendations should be made.

Transverse Strength

For determination of the transverse strength, *i. e.*, the resistance to crushing, the tubing was placed in a Tinius Olsen universal testing machine, and the load at which the tubing was flattened out sufficient to shut off the gas was noted. The data from our tests are shown in the tables. The following observations and conclusions are drawn as to the relation between transverse strength and the character of the tubing.

It was our interpretation of the committees' proposal that "tubing to be capable of withstanding without crushing" meant without crushing sufficiently to cause either leakage or shutting off of the gas. We believe this should be clear in the specification, and have so modified the wording. However, it is not intended that our tests should be used as a guide to the strength of tubing in respect to its resistance to rupture under transverse load, since they apply only to the matter of actual crushing to shut off the passage of gas.

(1) In most tubings the transverse strength depends primarily upon a metallic core or an interior or exterior wire helix; sample No. 7 was the only one without such construction that came up to the proposed requirement of resistance to 100 pounds per lineal inch. This tube was one built much like a garden hose.

(2) The transverse strength of samples in Class I (with metal core) is much greater than that of the other types, being usually above 300 pounds per lineal inch; but some samples in Classes II and III are also considerably above the proposed specifications of 100 pounds. The only tube equaling those with metal core was No. 31, which is of small diameter and has two wire helixes.

(3) If a metal core is required it can readily be made of sufficient strength to prevent serious crushing of the core or a momentary interruption of the gas supply, even if the tube is accidentally stepped on while in use.

(4) If otherwise satisfactory, a tubing which depends upon a good wire helix for transverse strength can be made sufficiently resistant against crushing to be regarded as safe in this particular, since a strength of 100 to 200 pounds is secured by this method of construction.

(5) Samples Nos. 8, 16, 22, 28 and 34, which had no metal core or wire helix, were very easily flattened out at 10 to 30 pounds per lineal inch. This shows the limitations of such construction and that without such wire or metal base a tubing should not be regarded as generally applicable, though it perhaps would be safe in certain special work.

(6) The larger diameter tubing, whether wire helix or metal core, generally is crushed more easily than that of small diameter, as is evident by comparisons of No. 24 with 31, 25 with 21, 29 with 3, and 5 with 2, of which pairs the first named differs from the second principally by being larger in diameter.

(7) It might appear from comparison of Nos. 3 and 29 with 2 and 25, respectively, that the bare metal tubing was less resistant to crushing than those covered with composition and fabric. However, this seems improbable, for No. 7 is as strong as Nos. 2 and 17, and one scarcely could credit any great strength to the single layer of cotton fabric. Therefore, it seems that Nos. 3 and 29 are weaker because of somewhat inferior metal, and our conclusion numbered (1) above seems justified.

From these observations it is evident that the proposed requirement of transverse strength is extremely easy of compliance for any metal-core or wire helix tubing; but in our opinion is it not necessary to make it more severe, since 100 pounds per lineal inch is the maximum load to be expected? In other words, we assume that the severity of treatment anticipated, and not the commercially possible strength, should determine the specification, in order that some less expensive form of construction that really would be adequate and safe may not be excluded from future consideration.

Tensile Strength

The tensile strength was determined in the same machine in which the transverse tests were made. The tests consisted in taking a firm grip on each end of a piece of tubing about 12 inches long and noting the maximum load before break.

Undoubtedly some leakage would occur through some of these tubings before such maximum load was reached, but the methods used in these preliminary tests did not permit determination of this point. However, the margin of safety above the proposed requirement is so great with the steel-core tubing, in which class leakage would be most probable, that we feel no hesitation in tentatively accepting the test of breaking strength as a guide.

The results of the tests of tensile strength which we have made are given in the tables; the following conclusions are drawn:

(1) Samples of Class I, with rubber-packed steel core, pass the proposed specifications, with a wide margin of safety in every case except sample No. 3. The majority of samples in this class are representative of good steel-core tubing, which has a tensile strength of 175 to 250 pounds.

(2) Of the steel-core, rubber-packed tubings, No. 9 is unquestionably of the best construction. Sample No. 3 is by far the weakest of this group, partly as a result of small diameter, partly because of apparently inferior material and design, and partly because it has no fabric or composition to contribute to its strength.

(3) Of the Class I tubings without packing, a number fall below the specifications in tensile strength, but if covered with metal braiding, as Nos. 50 and 54, they can be made strong enough.

(4) Of the rubber tubings, Nos. 7 and 18 each contain two layers of rubber, apparently of fine quality, and represent the best form of tubing without steel core which we have examined.

(5) Of the medium to fair grades of rubber tubings (samples Nos. 10, 16, 22, 23, 26, 28 and 34), the strength was largely dependent upon the thickness and quality of the rubber; but in one instance (No. 23) the use of a heavily threaded composition contributed largely to the strength.

(6) One of the most dangerous styles of rubber tubing on the market is illustrated by sample No. 8. This general class of tubing is not worthy of any consideration in the drafting of a specification.

SUMMARY OF TESTS—CLASS I. TUBINGS WITH METALLIC CORE

Sample	Approx. internal diameter (inch)	Pressure loss per 6 foot length (inch water press.)		Crushing load (pounds per lineal inch)	Tensile strength (pounds)	Pull to remove end piece (pounds)	Leakage (thousandths cubic foot per hour per 6 foot length)
		At 6 cu. ft. per hr.	At 30 cu. ft. per hour				
1	3/16	0.1	—	525	180-280	110-150	5-9
2	3/16	0.3	—	700	238-200	130-90	0
3	3/16	0.3	—	400	79-90	64-65	2-6
5	5/16	0.2	2.1	300	248-240	160-118	24-48
6	3/16	0.3	—	700	172-180	80-80	10-30
9	3/16	0.3	—	600	350-350	125-160	3-6
17	3/16	0.3	—	700	220-220	148	0
21	3/16	0.3	—	750	175-200	146	2-7
25	1/4	0.05	0.85	400	240-248	250	0-3
29	1/4	0.05	0	280	136-130	35	Leak in connection
49	1/4	0.1	1.6	500	70-60	*	0
50	1/4	0.1	1.6	700	1370	*	0
51	1/4	0.1	1.4	500	80	46-*	0
52	5/16	0.05	0.9	450	60-80	*	0
53	5/32	1.75	—	435	70	*	0
54	1/4	0.20	—	800	380	*	0
55	5/16	0.15	—	7[illegible]0	80	*	0
56	1/4	No test	No test	685	90	52	—
57	1/4	No test	No test	—	—	—	0

* Tubing broke before end pulled off.

CLASS II. TUBINGS WITHOUT METALLIC CORE, BUT WITH SOME RUBBER

Sample No.	Approx. internal diameter (inch)	Pressure loss per 6 foot length (inch water press.)		Crushing load (pounds per lineal inch)	Tensile strength (pounds)	Pull to remove end piece (pounds)	Leakage (thousandths cubic foot per hour per 6 foot length)
		At 6 cu. ft. per hr.	At 30 cu. ft. per hour				
7	1/4	0	0.70	150	104-100	100	3
8	5/16	0	0.20	10-10	48-48	—	3-7
10	5/16	0	0.60	200	68-70	60-80	2-6
16	1/4	0.20	2.7	25-17*	110-100	72-46	0-2
18	3/16	0.30	—	150	108-120	106-110	0
22	3/16	0.30	—	20	82-62-80	*	0
23	1/4	—	—	180	100	—	—
26	5/16	0	0.35	200	72-74	50	Leak in connection
28	3/16	0.30	—	30	68-66-82	*	0
34	1/4	0.20	2.1	125	130-70-62	*	—

CLASS III. TUBINGS WITHOUT METALLIC CORE OR RUBBER LAYERS

Sample No.	Approx. internal diameter (inch)	At 6 cu. ft. per hr.	At 30 cu. ft. per hour	Crushing load (pounds per lineal inch)	Tensile strength (pounds)	Pull to remove end piece (pounds)	Leakage (thousandths cubic foot per hour per 6 foot length)
4	5/16	0	0.65	135-100	60-78-70-[illegible]3 62-58	*	1-9
11	3/8	0	0.50	130-65	100-105	74-80	0-2
14	5/16	0	0.4[illegible]	130	40-58-49-55-50	*	Leak in connection
24	5/16	0	0.55	180	190-218	—	—
31	3/16	0.25	—	370	215-210	118	2
33	1/4	[illegible]	1.70	190	195-180	168	14-18

* Tubing broke before end pulled off.

TESTS OF RUBBER END PIECES
Tensile Strength and Percentage Elongation at Break

Sample No.	Tensile strength		Percentage elongation at break
	Pounds per sq. in. of rubber cross section	Pounds for the end piece for minimum cross section	
1	944	462	450
	970	475	400
	1320	650	500
4	98	29	50
5	103	33	100
6	510	100	250
			200
11	165	64	50
			50
24	167	65	50
			50
34	165	60	200

(7) Of Class III, no more consideration should be given to materials like Nos. 4 and 14 than is credited to those like No. 8. This style is largely sold by 5 and 10-cent stores and similar establishments. Sample No. 11 is scarcely any better. It does have the advantage of a strong composition and fabric layer, which produces a tensile strength above the proposed requirement; however, it would fail to pass in other particulars.

(8) The tensile strength of samples Nos. 24, 31 and 33 illustrates the possibility of full compliance with this specification by use of a strong composition containing lengthwise threads.

Tubing is often accidentally subjected to pulls and strains of uncertain magnitude, but the 75-pound requirement seems adequate to protect the tubing against such strain; since all of the samples that are otherwise acceptable had a tensile strength considerably in excess of that figure, there will be no difficulty in meeting such requirement. Here again, however, we believe the wording should be more explicit, so that it will be evident that the tubing must not leak after being subjected to a 75-pound pull. We, therefore, suggest a slightly modified form for the specification.

Pull Required to Remove End Piece

No complete specifications have yet been proposed by the gas association committees for attaching the rubber ends to the flexible tubing, but it was evident from the number of leaks found around the end connections, and the small pull required to remove some of them, that this was one of the weak spots in many tubings.

Our tests of the strength of the joint were made by the same general method as was used in the tests of tensile strength. The results are presented in the tables, and the following general conclusions are drawn:

(1) In the rubber-packed, metal-core tubings the metal tailpiece which was screwed into the corrugations of the metal core seemed to be as tight and as strong as the other part of the tubing.

(2) When a rubber end was fastened over such metal tailpiece, the connection between tailpiece and tubing was stronger, in every case but one, than that between the tailpiece and the rubber. When the corrugations of the tailpiece were fine the grip of the rubber was good, requiring a pull of 100 to 170 pounds to separate it (see especially samples Nos. 1, 9, 7 and 18; also Nos. 31 and 33, which were very similar); but with coarse corrugations on the metal tailpieces, *e. g.*, samples Nos. 10 and 26, the rubber seems to pull off much more readily at 50 to 80 pounds.

(3) When metal end pieces were attached by making the tailpiece a part of the metal end itself, the strongest construction was obtained as shown by samples Nos. 2, 17, 21, 25, 22 and 28, all of which pulled off at 100 to 250 pounds, or resisted sufficient pull to break the tubing itself (in each case more than 100 pounds).

(4) When a rubber end was attached to a wood plug, as in Nos. 16, 34, 4, 11 and 14, the break occurred at 50 to 80 pounds, either in the tubing or by separation of all or part of the rubber end piece, according to the relative strength of the parts. One exception to this group was sample No. 5, which was unusually strong and well made.

(5) When the rubber end was attached to bare metal, as Nos. 3, 29 and 51, or to metal covered with a single fabric layer, the strength of the joint was small and separation of the end occurred with a pull of 30 to 80 pounds. Moreover, this style of joint is much weakened by the strains which occur while the tube is being attached to or detached from piping or appliances.

(6) In the case of brass and steel tubings without rubber packing, to which metal ends were brazed or soldered, the point invariably was stronger than the tubing itself.

As a general conclusion, we believe the joint between tube and end piece could properly be required to be of such strength as to easily resist a pull of at least 75 pounds, which is the strength recommended for the tubing itself.

Tightness When Straight, Bent or Twisted

The tightness of various tubing samples was determined by attaching one end of the tubing to the outlet of a wet gas meter (1/10 cubic foot per revolution) and stoppering the other end. Gas was turned on through the meter and maintained in the tubing at a pressure of 6 inches of water. After the gas had stood in the tubing for about 20 minutes, the leakage was determined over intervals of 5 minutes.

In order to make sure that no leakage occurred at the connections to the meter or at the stoppered end, these points were tested with soapy water. The figures reported as leakage, therefore, represent the actual seepage through the tubing or through such small leaks around the end pieces as were too small to locate with the soapy water.

To determine whether the tubing would develop any additional leakage when bent into a circle of about 3 inches in diameter, each sample was coiled about a form of that size and another leakage test made. This observation was then repeated 20 minutes later, with the tubing still coiled about the form. Again after straightening the tubing, the 5-minute observation was made, and still another test 20 minutes after straightening. It was thought that these tests at intervals would reveal any fatigue of the rubber packing or the composition layers of the tubing that might occur during short periods after bending or the recovery occurring within a short time after the straightening of the tube.

Similar leakage tests were made on the tubing after twisting a 1-foot length of it through 180°, both clockwise and counter-clockwise. The results of these observations are given in the tables only in a summarized form, since practically no significant differences in leakage were noted under the different conditions. The two values given for each sample, therefore, represent the minimum and the maximum value for that material, and do not bear any special relation to the question of bending or twisting.

There are tubings on the market which have some very desirable properties, but cannot be twisted very much without leaking. It seems that such tubing might be entirely satisfactory if it were so strong that it required more force to twist it than would be applied to it in ordinary use. Attaching a hose over a nozzle is usually accomplished with a twisting motion, especially if the nozzle is too large for the end piece. It was

found by a few rough tests that the force one might apply in such a case was about equal to a weight of two pounds at the end of a lever 12 inches long. And this minimum requirement is incorporated into the specifications.

As will be seen from the tables, the leakage was very small; but very few samples would comply with the committee's proposed requirement of showing absolutely no leakage. Most of the detected leaks were near the end connections, and a large number of such leaks were found on samples which were, therefore, discarded from further tests. Practically all of the tubings were so nearly tight as to make it impossible to judge anything as to the relation between tightness and makeup of the tube. However, we believe that a longer series involving life tests will develop the necessary information as to the tightness of the tubing after use under various conditions. Such further work is contemplated.

It is evident that the leakage is of such small magnitude in practically every case as to introduce no element of hazard under ordinary conditions of use, unless large deterioration resulted with time. We believe, therefore, that the specifications should allow such small leakage as has been found in the better grade samples which we have tested. Indeed, we think this would be essential if precise compliance with the proposed specifications were expected. It appears to us that it would be entirely proper to permit tubings that would not show leakage in excess of 0.02 cubic foot per hour, 6-foot length, though it may be entirely feasible to specify a limit of 0.01 cubic foot per hour.

Pressure Loss

Pressure loss on the different samples was determined by having a pressure gauge at each end of a 6-foot section of a gas tube, including end pieces, and noting the loss in pressure when passing gas at either 5 or 30 cubic feet per hour. The pressure loss in most samples was not excessive. In the few cases for which it was large it was caused by a constriction in each end which resulted from the method by which the end piece was attached. The results of our tests are presented in the tables.

If the interior diameter of the tubing is specified, the only object in specifying the pressure loss is to prevent any such undue constrictions, so that the tubing will deliver a certain quantity of gas at a minimum loss in pressure. After the methods for attachment of ends are fully developed it will not be necessary to retain any specifications for pressure loss, since the limitations of internal diameter at these end pieces will fully care for this detail of performance. In the meantime, if the marking of tubing to show the gas capacity, as proposed in our specifications, is adopted generally by the manufacturers, the matter is adequately cared for.

Flexibility

The tubing samples which we have tested were kept for several months, coiled loosely in a large basket, as a convenient means of storage while awaiting test. After they had been coiled in this way for such period, it was found that no significant flexibility tests could be made, since the tubing had a permanent "set" in different directions, more or less determined by the direction of its bending while stored. It is anticipated that similar difficulty would be met in any case if the samples had not been kept straight until used for the test. For this reason, the tests suggested by the committee would often be difficult of application.

The committee's proposed specifications require flexibility of tubing suffi-

cient to permit it "to hang in a graceful, natural curve" from any point of support or attachment. This is perhaps desirable from the commercial point of view, but we cannot see any need for making this detail a requirement in the specifications. If the tubing can be bent into a small circle without any apparent effort, and will stay tight after such bending, it should be flexible enough for most purposes. For uses where great flexibility is essential to good appearance, the customer can select those varieties of tubing which are specially suited to his needs; for general uses the tests in the following modified specifications will guarantee sufficient flexibility.

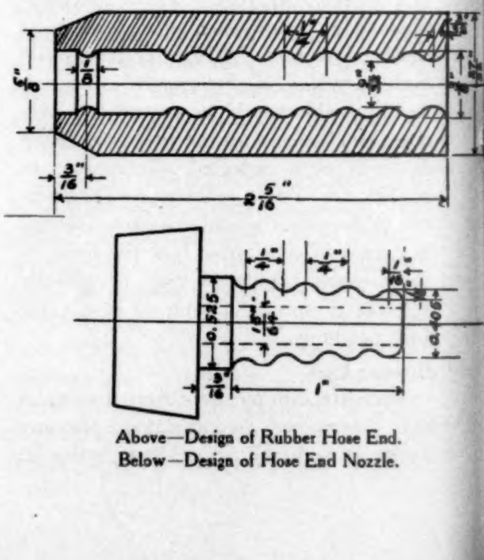
Although we believe that the importance of the requirement for flexibility has been generally exaggerated, we also believe it is necessary that where a tubing is not flexible it should offer sufficient resistance to twisting or bending so that it will not readily be damaged. This idea has been kept in mind in drawing the modified specifications, but because it is so difficult to know just what the hazard is from this source, and also because it is difficult to define a proper test, the suggested requirements have been made very liberal. To require a great degree of flexibility will certainly limit the construction in many ways and will necessitate sacrificing certain other features which for many purposes would be much more valuable than extreme flexibility. We shall, therefore, suggest certain specifications for a trial, with the idea of changing the numerical values whenever experience has shown us the need of revision. The same test will take care of the matter of kinking, for which some test was felt to be necessary.

In many cases it would seem absolutely unnecessary to require a tubing to be bent into a 3-inch circle, as proposed in the original committee report. Ordinarily, as the tubing would be coiled when out of use, it would be in a circle of about 12 inches, but it would often be bent into a much smaller circle and to retain its tightness when bent in a 6-inch circle seems a necessary requirement. To provide for sufficient resistance to kinking and leakage of tubing which can readily be bent into smaller circles, a second requirement is necessary to provide a measure for this feature of strength, and such a requirement is given in paragraph 5 (*b*) of our proposals.

Heating Test

An electrically heated oven, the temperature of which could be maintained very uniform, was used for heating a number of the samples for 48 hours at 100° F., as prescribed in the specifications. An open vessel of water in the oven kept the air saturated with moisture at this temperature.

Not all the samples were examined in this way, but those which seemed at all likely to show bad effects from such treatment were subjected to test. None of the samples showed serious effects from stickiness or oozing of the composition.



Above—Design of Rubber Hose End.
Below—Design of Hose End Nozzle.

It also was desired to determine what, if any, influence the heating had upon the tensile strength. A temperature of 100° F. for 48 hours would, of course, not be expected to have any appreciable effect on the steel-core samples of Class I, nor even upon those of Class II, which were mostly of rubber. Samples of Class III, which depended for their tensile strength almost entirely on the cotton fabric covered with compound, might be expected to deteriorate on exposure to heat. However, only in the case of sample No. 8 was there any considerable loss in tensile strength; No. 11 was somewhat stronger (probably because of irregularities in the samples; and the others were about the same as in previous tests).

A temperature of 100° F. would undoubtedly cause deterioration of such composition layers of glycerine and glue, or of rubber, if continued over considerable periods of time. But it seems that tubing should be able to withstand a considerably higher temperature for short periods, for there is no question but that, in actual use, the tubings often are subjected to considerably higher temperatures.

If 100° F. is the limit of heat resistance of ordinary practical tubing, such tubing should be plainly marked and not used where higher temperatures would be reached.

Several tests were made on tubings which were subjected to higher temperatures. At 300° F. tubings Nos. 4, 11 and 14, of Class III, gave off large volumes of gas and smoke, and after 15 minutes at this temperature the tubings could be picked apart with the fingers. At this temperature the rubber-packed metallic tubings were also ruined within a few minutes. Where the metal was bare, as in sample No. 3, the rubber oozed out of the joints, but the tubing did not leak; after the tubing was removed from the oven and allowed to cool, the joints became loose upon further handling. In metallic tubings covered with composition and cloth, the rubber thread packing seemed to be protected slightly, but the composition oozed through the cloth covering.

The cloth coverings on all the samples that were tried were readily combustible, so that they quickly took fire upon being brought in contact with a flame. The hazard from such a combustible cloth covering would more than offset any advantage that its presence would give in respect to heat-resisting properties of the tubing as mentioned in the previous paragraph. In fact, the advantage of the metallic core is largely lost unless the outer fabric layers are reasonably incombustible.

Freezing Tests

Since gas tubing would seldom be subjected to a temperature as low as 0° F., it seems unnecessary to require it to remain very flexible under such severe conditions. Unquestionably, however, some flexibility should be retained in the tubings at reasonably low temperature, *e. g.*, 32° F., for otherwise the composition may readily be broken when a cold sample is bent. We believe, therefore, that reasonable flexibility requirement should be fixed for 32° F., and are so recommending in our specifications.

Rubber Slip Ends

End pieces from the same lot of tubing used for the tubing tests were used for tests; the numbers given to the end-piece samples correspond to the numbers of the tubing samples. These were tested for tensile strength and percentage elongation at break; the strength is shown both in terms of pounds per square inch of cross-section of rubber and for the whole end piece calculated

for the point of minimum rubber cross-section. These end pieces had been stored for about a year and a half, and probably had deteriorated slightly, but for that very reason the samples should be more representative of average material which the buyer would get.

The results given in the tables bring out strikingly the wide difference in the quality of the various rubber end pieces, and when one considers that probably the greatest source of hazard from gas tubing is from the defective end pieces, it seems that a small additional cost should not prevent the adoption of the better quality. The necessity for a high-grade end piece is especially important until there is some uniformity and standardization of the size of hose and nozzles. If the nozzle was always the correct size for the particular end piece, so that there would be no undue strain or stretching of the rubber, a much smaller degree of flexibility and strength would be needed.

The specifications proposed in this report are not based upon these tests of aged end pieces, but upon other work with new rubber, which will very readily, if of good grade, comply with our recommendations. In fact, very much more severe specifications would be commercially possible, but at present such greater severity seems unnecessary.

Detachable Metal End Pieces

The detachable metal end pieces appear very promising, and if the ends of the tubing are properly prepared for these end pieces, they should be very satisfactory. The tightness depends entirely upon a rubber ring which forms a gasket between the two metal parts, and by being thus squeezed is forced against the tubing. With the bare metal tubing it seemed impossible to force the rubber ring into the corrugations of the tubing sufficiently to make a gas-tight joint. With one of the composition and cloth-covered tubings, a practically tight connection was made, but a larger tubing of this same kind leaked considerably.

From the above, it appears that bare metal tubings and those covered with a loose cloth covering need to have the ends prepared in some way to assure a gas-tight joint. The strength of the joint is ample, as shown by the following tests where the joint was made up with the fingers without any tools. Sample No. 6, an uncovered metal tube, broke at 80 pounds pull; but the tubing was damaged before the end pulled off. Sample No. 7, a 3/16-inch covered tubing and No. 8, a 5/16-inch covered tubing, broke at 130 and 100 pounds, respectively.

Discussion of Results

The specifications for the construction of tubing may well be definite in certain details, but it is essential that they be so worded that they are minimum specifications, *i. e.,* permitting nothing inferior to the standard, but allowing as much better construction as the maker may wish to afford. Futhermore, it seems desirable that there be included as a guide to the makers of tubing, suggestions as to the preferred grades or details of construction, which are not yet required, but which may in later requirements be made compulsory.

The original proposals of the committees went far beyond this point in their detail, for they limited the makers to one class of tubing. This appears to us to be undesirable, for several reasons, as follows : (*a*) A specific requirement prevents the exercise of ingenuity by the makers; (*b*) it precludes changes in construction which might greatly reduce the cost of manufacture, even though this were found to be practicable without detriment to the per-

formance of the tubing; (*c*) it does not provide the desirable variety of styles of tubing for various uses and (*d*) it may tend to support unduly one or more makers who are especially well equipped to supply at low cost the style of material covered, to the disadvantage of other makers who may be able to supply other styles which are substantially as good.

The object of any specifications for flexible tubing is obviously the elimination of the more dangerous types and the encouragement of use of the best available forms. It appears that too definite or limited specifications may defeat their own end by making it impracticable to expect full compliance at the outset. In our judgment, therefore, it is better that a number of varieties of tubing be permitted, at the outset, at least, since it is probable that it would be utterly impossible to supply the entire demand for tubing with any single style, no matter how good it might be. Then, it would be expected that revisions of the specifications would gradually make them more rigid, so that eventually only the highest grades would be permissible under these requirements.

It does not appear to us that there is any one style of tubing that can properly be said to be far superior to all others, and until such tubing is available, it would seem best to base the specifications largely upon the performance of the tubing. The required performance will in some cases be expressed in very specific form and be susceptible of determination by test; in other particulars the requirements will have to be general in nature, either because of the limited amount of information thus far available, or because it is impracticable to make tests of the characteristics in question.

In addition to the specifications for performance, as already discussed in the sections where the test results are presented, we think that some consideration must be given to the following details of construction, which are of some importance in securing the best grades of tubing:

(1) In general, a non-combustible metal base for the tubing is desirable, but it should not be required for all classes of tubing. If it is not used, some alternate form of construction to secure the required strength, resistance to crushing, and durability, is, of course, essential. It also is very desirable that the alternate construction be such that the tube will not readily be burned or melted apart sufficiently to allow the gas to escape in large quantities, even when subjected to somewhat excessive temperatures.

It must be recognized that with the exception of some of the new varieties of all metal tubings, the tubings in general use cannot be considered non-combustible. A temperature of 300° F. is sufficient to melt or dry out the rubber packing, and although no immediate leaks may occur, the tubing is practically ruined and a source of danger subsequently. A combustible cloth covering introduces an additional hazard which could be eliminated by a slight expense in fireproofing the material.

(2) It does not seem desirable that the precise nature of the metal core of the tubing be defined by specification, since any construction meeting the requirements as to performance would be acceptable. For this reason, the requirements of "one unbroken strip of metal," "wound spirally," "an interlocking seam" and "a continuous rubber thread-like gasket" appear inexpedient. Splicing of lengths should, however, be forbidden.

(3) The uninformed user of tubing will often allow tubing to come in

contact with the hot parts of the appliance with which it is used, if it seems from its appearance that this will do no damage. Therefore, if a tubing is made to appear fireproof, it is essential that it be actually of such nature that ordinary use in work that exposes it to rather high temperatures will not produce serious deterioration.

(4) When any composition layers such as those made from glue or glycerine mixtures are employed, they should be adequately wrapped with paper or cloth layers, to prevent mechanical damage during ordinary use and to prevent any stickiness or softening from heat or moisture under ordinary conditions.

(5) Tubing which is constructed with layers of rubber composition and which is dependent primarily upon this for strength and tightness, should preferably be made up with fabric incorporated in the rubber layers, after the fashion of garden hose. The rubber must, of course, be made up in a high-grade and durable composition.

(6) For tubing which is specially constructed for use with gas irons, it is very desirable that at the end near the iron there be a reinforcing spiral wire, sleeve, or other support. This will prevent damage to the tube from the repeated bending at one point which is likely to result unless special precautions are taken to distribute over an appreciable length of the tube the bending that necessarily occurs during the use of the iron.

(7) It does not appear that a specification intended primarily to cover safe construction of tubing need include requirements as to the color or nature of the outer fabric layers. Unquestionably, it is desirable that the cover be dyed with a fast color; but such details will be determined by the makers in accordance with commercial demands, and can properly, therefore, be left to them for decision.

(8) The proposed requirement of dimensions of tubing recognizes the probable need for other sizes in addition to the three specifically mentioned; and we believe that the rule must be so loosely drawn that any size can be manufactured. There is some advantage in uniformity of sizes in order that it may be easier to fit the end pieces and ferrules to tubings of different makes; but there does not appear to be sufficient advantage in any such rule as to justify including this requirement in the general specifications.

(9) It is highly desirable that the purchaser be able to determine the quantity of gas which any sample of tubing will deliver, so that he may purchase appropriate material. However, the external diameter is a poor guide to this determination, even when there is some limit as to the relation between inside and outside dimensions, because usually neither the customer nor the salesperson is competent to estimate the gas capacity even from inside dimensions. It is believed that some marking of gas capacity would be desirable, and it is included as a recommendation in the revised specifications.

(10) In order to make the manufacturers of tubing responsible to a greater degree for their product, it seems desirable that the maker's name be indicated on the tubing, even up to the time it reaches the user. This may be accomplished by markings on the metal or rubber ends, or by a small tag attached to each length of tubing. This practice is recommended in the revised specifications.

Modified Specifications Proposed

The following modified specifications are presented for further consideration. It is believed that they will permit sev-

eral of the better classes of tubing, but that a large percentage of the inferior grades, including all those which seem inherently objectionable from the standpoint of safety, will be precluded. In a number of instances it is still impossible to draft the proper rules to cover features which must be taken into account in the complete specifications. In some such cases only the need for the rule is indicated; in others the rule is proposed in a general form, suitable for tentative adoption, with the idea that more definite specifications can later be formulated to supersede this preliminary regulation.

As pointed out above, these recommendations are not considered as final in any sense, but are submitted for criticism and comments. The Bureau of Standards will, therefore, welcome communications from all interested parties.

TENTATIVE SPECIFICATIONS FOR FLEXIBLE GAS TUBING PROPOSED FOR CRITICISM AND COMMENT

Flexible gas tubing which is made and sold to the general public for use with city gas or for similar purposes shall conform to the following specifications of construction and performance:

1. General Construction

(a) In general, tubing as offered for sale to the general public shall be made up of suitable lengths of flexible tube with end pieces of rubber or metal already attached.

It is recommended that there be no general sale by retailers of long lengths and separate end pieces which it is intended that the user will assemble for himself. Furthermore, it is recommended that makers of end pieces or of tubing do not sell their product unless in complete assembled form, except to dealers who are known to have facilities for, and intended to perform properly the work of, assembling.

(b) If tubing is made to appear to the user to be fireproof or substantially resistant to heating, then it shall actually be made so resistant to high temperature that such contact with the hot parts of an appliance or the hot products of combustion of gas as may readily occur will not cause it to leak or be otherwise seriously defective.

2. Nature of Various Layers

(a) *Metal Core.*—It is recommended that a strong and substantially gas-tight metal core shall be used for all tubing intended for sale to the public for general uses. The rubber thread-like packing, which may be used to make such core gas-tight, shall not be the sole means for preventing leakage, but a layer of rubber, composition, or other suitable gas-tight material must also be employed. Provided, however, that if the metal core is made up to be of itself gas-tight, or is made so with suitable non-combustible packing, then this outer layer of rubber or composition, though often desirable, is not always required. Splicing of the metal core shall be avoided whenever practicable; when necessary, it must be done in such manner as to leave the tube as strong and tight as an unspliced section.

(b) *Rubber Layers.*—If layers of rubber compound are used, they shall have incorporated in them or closely adherent to their surface suitable fabric layers. When such layers of rubber compound are used without metal core, even though a reinforcing wire helix be used, it is recommended that several layers of strong fabric be incorporated in the rubber to give a construction similar to that of garden hose. The composition of rubber layers should be suitable and vulcanization adequate so that no deterioration causing leakage or serious loss of flexibility will occur during ordinary careful use for a period of at least two years.

(c) *Composition Layers.*—Any composition layers, for example, those containing glue, glycerine, or similar materials, shall be so made that they will resist all ordinary service without cracking, oozing or becoming sticky.

(d) Tubing made up without either metal core or rubber layer such as recommended in (b) must not be sold.

3. Labeling

(a) It is recommended that each length of tubing offered for sale be labeled with the name and address of the maker by suitable marking on the end connections or by a small tag attached to the tubing, or both.

(b) It is recommended that each length of tubing be marked clearly to show the maximum rate of gas flow for which it is suited. For this purpose the rating shall be based upon the cubic feet per hour of gas of specific gravity 0.60 which will pass through the tubing, including the end pieces, with a loss of pressure of not greater than 5/10 inch of water.

4. Strength

(a) The tubing shall be so resistant to crushing that it will support a transverse load of 100 pounds per lineal inch without either permitting a leakage of gas or collapsing enough to shut off the flow of gas.

(b) The tubing shall be capable of withstanding, without leaking either during or after the application of the load, a steady lengthwise pull equivalent to a weight of 75 pounds.

(c) The tubing shall be capable of withstanding without leakage either during or after the test a twisting movemen acting clockwise or counter-clockwise sufficient either (1) to produce an angular deflection of 180 degrees per foot of length or (2) to produce a strain equivalent to that given by a 2-pound weight at the end of a lever 12 inches long.

5. Flexibility

(a) The tubing shall show no increase in leakage when bent into a circle six inches in diameter, if tested in accordance with paragraph 6 (b) either, (1) at once after such bending; or (2) after being so bent for 20 minutes; or (3) after straightening the tube following a period of 30 minutes in the bent position.

(b) The tubing shall be of sufficient strength to resist without damage or kinking a pull applied at the ends of the tube, at least as great as shown in the following tabulation:

Smallest circle into which tubing can be bent without leaking or kinking.	Maximum pull on ends which tubing must resist when formed into a loop and pulled into a circle of size indicated.
3 inches or less	2 pounds weight
3 to 4 inches	4 pounds weight
4 to 5 inches	6 pounds weight
5 to 6 inches	8 pounds weight

(c) The tubing shall retain its flexibility at low temperature sufficiently so that after being kept at 32° F. for six hours it will pass the bending test prescribed in the preceding paragraph.

6. Tightness

(a) The tubing shall be sufficiently gas-tight so that a 6-foot length, including the end pieces, shall show a leakage of not more than 0.02 cu. ft. of gas per hour.

(b) The test for tightness shall be made as follows: One end of the tube shall be connected to the outlet of a gas meter graduated to read to 0.001 cu. ft., and with the other end stoppered the tube shall be subjected to a gas pressure of six inches of water for a period of at least five minutes.

7. Resistance to Heating

(a) Tubing shall be so resistant to heat that it will not soften sufficiently

to become sticky or for any part to ooze out through the paper and fabric layers when the tubing is kept for 24 hours at a temperature of 125° F. in an atmosphere saturated at that temperature with water vapor.

8. Rubber Slip Ends

(a) If rubber slip ends are used they shall be made of rubber compound of the following characteristics:

1. Material: The rubber ends shall be made from a properly vulcanized compound containing not less than 60 per cent. by volume of fine para or best grade hevea-plantation rubber. The sulphur available for vulcanization shall not be over 8 per cent. of the weight of rubber present. The remainder of the compound shall consist only of inorganic material. No rubber having previously been vulcanized shall be used.

   NOTE: (This is approximately equal to a minimum of 35 per cent. by weight of rubber and a maximum of 2.8 per cent. by weight of sulphur for vulcanization of a compound of 1.6 specific gravity.)
2. Physical properties: The rubber shall show upon testing a tensile strength of not less than 1,200 pounds per square inch; an ultimate elongation of not less than 350 per cent.; and a permanent set of not more than 25 per cent. after having been stretched 300 per cent. for ten minutes and then allowed to rest for ten minutes.

   NOTE: One lot of specimens shall be tested for strength and elongation which have not been previously stretched and a separate lot of specimens shall be used for the set test.
3. Methods of Testing: All physical and chemical tests shall be performed according to the standard procedure in use at the Bureau of Standards, described in the latest edition of circular No. 38 of the bureau.

(b) The rubber slip end shall preferably be shaped in accordance with the accompanying sketch; but any other shape may be used if it can be conclusively shown to be of substantially equivalent value.

9. Attachment of Slip Ends or Fittings

The joint between the slip end and the tubing shall be so tight and strong that it will withstand the tests prescribed for the tubing itself in the following particulars: Tensile strength (par. 4b); twisting (par. 4c); and tightness (par. 6a and b).

The foregoing specifications are not yet finally approved. Make it a point to forward your suggestions and criticisms to the Bureau of Standards at once.

PROF. LUCKE HONORED

The following announcement which appeared in the New York daily press will prove of great interest, we are sure, to gas men:

"Breaking a rule which bars the issuance of commissions higher than Lieutenant-Commander to men from civil life, the Navy Department has bestowed upon Professor Charles E. Lucke, of the School of Mechanical Engineering, Columbia University, the rank of Commander of the Naval Reserve Force in recognition of his services during the war.

"Word to this effect has been received from Franklin D. Roosevelt, Assistant Secretary, who also makes it known that a special citation commends Professor Lucke 'For valuable assistance in training personnel to meet the great demand of the war.'"

Professor Lucke is very well known to the gas fraternity; his work on surface combustion and his paper before the 1913 Convention of the American Gas Institute attracted much attention.

Associations Affiliated with A. G. A.

Canadian Gas Association

Pres.—C. C. Folger, Kingston, Ont.
V.-Pres.—V. S. McIntyre,
C. S. Bagg.
Sec.-Tr.—G. W. Allen, 19 Toronto St., Toronto, Ont.
Conv., 1919, Aug. 21-22—Niagara Falls, Ont.

Illinois Gas Association

Pres.—H. S. Whipple, Rockford, Ill.
V.-Pres.—W. M. Willett.
Sec.-Tr.—H. H. Clark, 72 W. Adams St., Chicago, Ill.
Conv., 1920, March 17-18.

Indiana Gas Association

Pres.—R. A. Ziegler, Anderson, Ind.
V.-Pres.—J. D. Forrest.
Sec.-Tr.—R. E. Burke, Citizens Gas Co., Indianapolis, Ind.
Conv., 1920, April 28.

Iowa District Gas Association

Pres.—Geo. D. Roper, Rockford, Ill.
V.-Pres.—W. H. Taylor,
C. N. Chubb.
Sec. Tr.—H. R. Sterrett, Des Moines Gas Co., Des Moines, Ia.
Conv., 1920.

New England Association of Gas Engineers

Pres.—A. M. Barnes, Cambridge, Mass.
V.-Pres.—W. F. Norton,
Burton Smart.
Sec.-Tr.—N. W. Gifford, 38 Central Sq., East Boston, Mass.
Conv., 1920, Feb. 18-19—Boston, Mass.

New Jersey State Gas Association

Pres.—C. W. Hoy, Glassboro, N. J.
V.-Pres.—R. H. Garrison.
Sec.-Tr.—Wm. P. Adams, Millville, N. J.
Conv., 1920.

Pennsylvania Gas Association

Pres.—G. F. Speaker, Lebanon, Pa.
V.-Pres.—O. H. Heckert,
J. L. Mather.
Sec.-Tr.—L. R. Dutton, Jenkintown, Pa.
Conv., 1920, April 14-15—Philadelphia, Pa.

Southern Gas Association

Pres.—Noble Clay, Durham, N. C.
V.-Pres.—E. S. Dickey,
J. H. Haggerty.
Sec.-Tr.—M. A. Bowlin, Macon, Ga.
Conv., 1920, Norfolk, Va.

Wisconsin Gas Association

Pres.—Bruno Rahn, Milwaukee, Wis.
Sec.-Tr.—Henry Harman, 182 Wisconsin St., Milwaukee, Wis.
Conv., 1920, Milwaukee, Wis.

OTHER ASSOCIATIONS

Empire State Gas & Electric Association

Pres.—E. H. Palmer, Geneva, N. Y.
V.-Pres.—H. W. Peck,
E. H. Rosenquest.
Sec.-Tr.—C. H. B. Chapin, 29 W. 39th St., New York, N. Y.
Conv., 1919, Oct. 13-18—New York, N. Y.

Michigan State Gas Association

Pres.—Samuel Ball, Bay City, Mich.
Sec.-Tr.—A. G. Schroeder, Grand Rapids, Mich.
Conv., 1919, September 17-18—Detroit, Mich.

Natural Gas Association of America

Pres.—Bert. C. Oliphant, Buffalo, N. Y
V.-Pres.—Harry J. Hoover,
Ogden K. Shannon,
H. A. Quay.
Sec.-Tr.—Wm. B. Way, 904-5 Oliver Bldg., Pittsburgh, Pa.
Conv., 1920, Atlantic City, N. J.

Pacific Coast Gas Association

Pres.—John D. Kuster, San Jose, Cal.
Sec.-Tr.—Henry Bostwick, 445 Sutter St., San Francisco, Cal.
Conv., 1919, September—Los Angeles, Cal.

Society of Gas Lighting

Pres.—Alex. H. Strecker, Newark, N. J.
V.-Pres.—W. Cullen Morris.
Sec.—Geo. G. Ramsdell, 130 E. 15th St., New York, N. Y.
Treas.—Wm. J. Welsh
Conv., 1919, December 11.

Southwestern Electrical and Gas Association

Pres.—Burr Martin, Dallas, Texas.
V.-Pres.—A. Hardgrave,
C. E. Corder,
A. H. Warren.
Sec.—H. S. Cooper, Slaughter Bldg., Dallas, Texas.
Treas.—J. B. Walker.
Conv., 1920.

Texas Gas Association

Pres.—W. H. Sedberry, Marshall, Texas.
Sec.—C. H. Seidenglanz, Dallas, Texas.
Conv., 1919, Oct., 14-15, Houston, Texas.

OCTOBER 13--18

FIRST ANNUAL CONVENTION

Classified Directory--Manufacturers of Gas Equipment

Company Members Only, American Gas Association, Inc.

ARC LAMPS (Gas)
- General Gas Light Co., New York, N. Y., and Kalamazoo, Mich.
- Welsbach Co., Gloucester, N. J.

BENCHES
- Russell Engineering Co., St. Louis, Mo.
- The Gas Machinery Co., Inc., Cleveland, Ohio

BENCH IRON WORK
- Isbell-Porter Co., Newark, N. J.
- Russell Engineering Co., St. Louis, Mo.
- The Bartlett Hayward Co., Baltimore, Md.
- The Gas Machinery Co., Cleveland, Ohio
- The Improved Equipment Co., 60 Wall St., New York, N. Y.
- The Parker-Russell Mining & Mfg. Co., St. Louis, Mo.
- The Stacey Mfg. Co., Cincinnati, Ohio

BOILERS (Gas)
- Wm. M. Crane Co., 16 W. 32d St., New York, N. Y.
- General Gas Appliance Co., 103 Park Ave., New York, N. Y.
- Wm. Kane Mfg. Co., Inc., 1915 Adams St., Philadelphia, Pa.
- Kidde & Co., 169 Chambers St., New York, N. Y.
- F. W. Ofeldt & Sons, Nyack, N. Y.
- The Bryant Heater & Mfg. Co., Cleveland, Ohio
- The Improved Appliance Co., 419 Kent Ave., Brooklyn, N. Y.

BOILERS (Gas for House Heating)
- Kidde & Co., 169 Chambers St., New York, N. Y.
- The Bryant Heater & Mfg. Co., Cleveland, Ohio

BOILERS (Waste Heat)
- The Bartlett Hayward Co., Baltimore, Md.

BLOWERS, BOOSTERS, EXHAUSTERS
- Connelly Iron Sponge & Governor Co., 227 Fulton St., New York, N. Y.
- Isbell-Porter Co., Newark, N. J.
- Maxon-Premix Burner Co., Muncie, Ind.
- The Gas Machinery Co., Cleveland, Ohio
- The Improved Appliance Co., 419 Kent Ave., Brooklyn, N. Y.
- The C. M. Kemp Mfg. Co., Baltimore, Md.
- The Surface Combustion Co., 366 Gerard Ave., Bronx, N. Y.

BRAZING TABLES
- Rathbone, Sard & Co., Albany, N. Y.
- The Improved Appliance Co., 419 Kent Ave., Brooklyn, N. Y.

BROILERS (Hotel)
- Geo. M. Clark & Co., Div., Chicago, Ill.
- Wm. M. Crane Co., 16 W. 32d St., New York, N. Y.
- Rathbone, Sard & Co., Albany, N. Y.
- The Michigan Stove Co., Detroit, Mich.

BURNERS (Industrial)
- Wm. M. Crane Co., 16 W. 32d St., New York, N. Y.
- Equitable Meter Co., Pittsburgh, Pa.
- General Fire Extinguisher Co., Providence, R. I.
- General Gas Appliance Co., 103 Park Ave., New York, N. Y.
- International Hale Gas Mixer Co., Providence, R. I.
- Maxon-Premix Burner Co., Muncie, Ind.
- Tate-Jones & Co., Inc., 50 Church St., New York, N. Y.
- The Baltimore Gas Appliance & Mfg. Co., Baltimore, Md.
- The Eclipse Stove Co., Mansfield, Ohio
- The Improved Appliance Co., 419 Kent Ave., Brooklyn, N. Y.
- The C. M. Kemp Mfg. Co., Baltimore, Md.
- The Surface Combustion Co., 366 Gerard Ave., Bronx, N. Y.
- The A. H. Wolff Gas Radiator Co., 4 Great Jones St., New York, N. Y.

BURNERS (Lighting)
- American Meter Co., Inc., 105 W. 40th St., New York, N. Y.
- Wm. M. Crane Co., 16 W. 32d St., New York, N. Y.
- General Gas Light Co., New York, N. Y., and Kalamazoo, Mich.
- Lindsay Light Co., New York, N. Y., and Chicago, Ill.
- Welsbach Co., Gloucester, N. J.

BY-PRODUCT OVENS
- By-Product Coke Corp., Chicago, Ill.
- Semet-Solvay Co., Syracuse, N. Y.
- The Gas Machinery Co., Cleveland, Ohio
- The Improved Equipment Co., 60 Wall St., New York, N. Y.
- The Koppers Co., Pittsburgh, Pa.
- The Parker-Russell Mining & Mfg. Co., St. Louis, Mo.

BY-PRODUCT RECOVERY APPARATUS
- Isbell-Porter Co., Newark, N. J.
- The Bartlett Hayward Co., Baltimore, Md.
- The Gas Machinery Co., Cleveland, Ohio
- The Koppers Co., Pittsburgh, Pa.

CALORIMETERS
- American Meter Co., Inc., 105 W. 40th St., New York, N. Y.
- D. McDonald & Co., Albany, N. Y.
- Maryland Meter Works, Baltimore, Md.
- Nathaniel Tufts Meter Works, 455 Commercial St., Boston, Mass.

CASING, TUBING (Steel)
National Tube Co., Frick Bldg., Pittsburgh, Pa.

CHARGING COAL
Isbell-Porter Co., Newark, N. J.
The Bartlett Hayward Co., Baltimore, Md.
The Gas Machinery Co., Cleveland, Ohio

COAL AND COKE (Conveyors, Crushers, Screeners)
R. H. Beaumont Co., 315 Arch St., Philadelphia, Pa.
Isbell-Porter Co., Newark, N. J.
The Bartlett Hayward Co., Baltimore, Md.
The Gas Machinery Co., Cleveland, Ohio

COCKS (Ranges, Water Heaters, Service and Meter)
A-B Stove Co., Battle Creek, Mich.
Claus Automatic Gas Cock Co., Milwaukee, Wis.
Hays Mfg. Co., Inc., Erie, Pa.
Kitson Co., 2837 Oakford St., Philadelphia, Pa.
H. Mueller Mfg. Co., New York, N. Y., and Decatur, Ill.
Standard Brass Works, Detroit, Mich.
The Improved Appliance Co., 419 Kent Ave., Brooklyn, N. Y.
The Roberts Brass Mfg. Co., Detroit, Mich.

COMPRESSORS
Plant Engineering & Equipment Co., 192 Broadway, New York, N. Y.
The Improved Appliance Co., 419 Kent Ave., Brooklyn, N. Y.
The C. M. Kemp Mfg. Co., Baltimore, Md.
The Surface Combustion Co., 366 Gerard Ave., Bronx, N. Y.

CONDENSERS
Camden Iron Works, Camden, N. J.
Cruse-Kemper Co., Ambler, Pa.
Isbell-Porter Co., Newark, N. J.
The Bartlett Hayward Co., Baltimore, Md.
The Gas Machinery Co., Cleveland, Ohio
The Stacey Mfg. Co., Cincinnati, Ohio
The Stacey Bros. Gas Construction Co., Cincinnati, Ohio
Steere Engineering Co., Detroit, Mich.

COOKING AUXILIARIES
Wm. M. Crane Co., 16 W. 32d St., New York, N. Y.
Duparquet, Huot & Moneuse Co., 108 W. 22nd St., New York, N. Y.
The G. S. Blodgett Co., Burlington, Vt.
The General Gas Appliance Co., 103 Park Ave., New York, N. Y.
The Improved Appliance Co., 419 Kent Ave., Brooklyn, N. Y.

COUPLINGS
S. R. Dresser Mfg. Co., Bradford, Pa.

CYLINDERS (Pressure)
National Tube Co., Frick Bldg., Pittsburgh, Pa.

DECALCOMANIA PRODUCTS
The Meyercord Co., Inc., Chamber of Commerce Bldg., Chicago, Ill.

ELECTRIC CONTROLLING DEVICES
The Cutler-Hammer Mfg. Co., Milwaukee, Wis.

EXCHANGERS (Heat)
The Bartlett Hayward Co., Baltimore, Md.

EXPERT APPRAISAL
Steere Engineering Co., Detroit, Mich.

EXTRACTORS (Tar, Dust, Fumes)
Isbell-Porter Co., Newark, N. J.
The Bartlett Hayward Co., Baltimore, Md.

FITTINGS
A-B Stove Co., Battle Creek, Mich.
Will W. Barnes, 31 Chelsea Place, East Orange, N. J.
Claus Automatic Gas Cock Co., Milwaukee, Wis.
S. R. Dresser Mfg. Co., Bradford, Pa.
Eriez Stove & Mfg. Co., Erie, Pa.
General Fire Extinguisher Co., Providence, R. I.
Kitson Co., 2827 Oakford St., Philadelphia, Pa.
H. Mueller Mfg. Co., New York, N. Y., and Decatur, Ill.
Shapiro & Aronson, Inc., 20 Warren St., New York, N. Y.
Standard Brass Works, Detroit, Mich.
The Gas Machinery Co., Cleveland, Ohio
The Improved Appliance Co., 419 Kent Ave., Brooklyn, N. Y.
The Roberts Brass Mfg. Co., Detroit, Mich.
Welsbach Co., Gloucester, N. J.

FITTINGS (Malleable Iron)
Stanley G. Flagg & Co., 1421 Chestnut St., Philadelphia, Pa.

FLEXIBLE TUBING
Wm. M. Crane Co., 16 W. 32d St., New York, N. Y.
Titeflex Metal Hose Corp., Badger Ave., Newark, N. J.

FLASHLIGHTS AND BATTERIES
Will W. Barnes, 31 Chelsea Place, East Orange, N. J.

FUEL BRIQUETTING
General Briquetting Co., 25 Broad St., New York, N. Y.

FURNACES
Eriez Stove & Mfg. Co., Erie, Pa.
Geist Mfg. Co., Atlantic City, N. J.
Maxon-Premix Burner Co., Muncie, Ind.
Russell Engineering Co., St. Louis, Mo.
Tate-Jones & Co., Inc., 50 Church St., New York, N. Y.
The Improved Appliance Co., 419 Kent Ave., Brooklyn, N. Y.

The Parker-Russell Mining & Mfg. Co., St. Louis, Mo.
The Surface Combustion Co., 366 Gerard Ave., Bronx, N. Y.

GAS ENGINES
The Bartlett Hayward Co., Baltimore, Md.
United Lead Co., 111 Broadway, New York, N. Y.

GAS ENGINE COCKS AND VALVES
Standard Brass Works, Detroit, Mich.

GAS IRONS
A-B Stove Co., Battle Creek, Mich.
Wm. M. Crane Co., 16 W. 32d St., New York, N. Y.
Milwaukee Gas Specialty Co., Milwaukee, Wis.
Strause Gas Iron Co., Philadelphia, Pa.

GAS MIXERS
Wm. M. Crane Co., 16 W. 32d St., New York, N. Y.
Eriez Stove & Mfg. Co., Erie, Pa.
Geist Mfg. Co., Atlantic City, N. J.
General Fire Extinguisher Co., Providence, R. I.
Hays Mfg. Co., Inc., Erie, Pa.
Improved Appliance Co., Inc., 419 Kent Ave., Brooklyn, N. Y.
International Hale Gas Mixer Co., Providence, R. I.
Maxon-Premix Burner Co., Muncie, Ind.
Strait & Richards, Inc., Newark, N. J.
Tate-Jones & Co., Inc., 50 Church St., New York, N. Y.
The C. M. Kemp Mfg. Co., Baltimore, Md.
The Surface Combustion Co., 366 Gerard Ave., Bronx, N. Y.

GAS PLANTS (Blue)
The Bartlett Hayward Co., Baltimore, Md.
The Gas Machinery Co., Cleveland, Ohio
The Improved Equipment Co., 60 Wall St., New York, N. Y.

GAS PLANTS (Carbureted Water)
Gas Machinery Co., Cleveland, Ohio
The Bartlett Hayward Co., Baltimore, Md.
The Improved Equipment Co., 60 Wall St., New York, N. Y.
The Stacey Mfg. Co., Cincinnati, Ohio

GAS PLANTS (Coal) (Engineers)
Camden Iron Works, Camden, N. J.
Isbell-Porter Co., Newark, N. J.
Russell Engineering Co., St. Louis, Mo.
Semet-Solvay Co., Syracuse, N. Y.
Steere Engineering Co., Detroit, Mich.
The Bartlett Hayward Co., Baltimore, Md.
The Gas Machinery Co., Cleveland, Ohio
The Improved Equipment Co., 60 Wall St., New York, N. Y.
The Parker-Russell Mining & Mfg. Co., St. Louis, Mo.
The Stacey Mfg. Co., Cincinnati, Ohio
The Stacey Bros. Gas Construction Co., Cincinnati, Ohio

HEATERS (Room)
Geo. M. Clark & Co. Div., Chicago, Ill.
Wm. M. Crane Co., 16 W. 32d St., New York, N. Y.
Detroit Stove Works, Detroit, Mich.
Eclipse Gas Stove Co., Rockford, Ill.
Eriez Stove & Mfg. Co., Erie, Pa.
Estate Stove Co., Hamilton, Ohio
Geist Mfg. Co., Atlantic City, N. J.
General Fire Extinguisher Co., Providence, R. I.
General Gas Light Co., New York, N. Y., and Kalamazoo, Mich.
Illinois Specialty Mfg. Co., Bloomington, Ill.
Kidde & Co., 169 Chambers St., New York, N. Y.
Lawson Mfg. Co., Pittsburgh, Pa.
New Process Stove Co. Div., Cleveland, Ohio.
Reliable Stove Co. Div., Cleveland, Ohio.
Reznor Mfg. Co., Mercer, Pa.
Roberts & Mander Stove Co., Philadelphia, Pa.
Strait & Richards, Inc., Newark, N. J.
The Baltimore Gas Appliance & Mfg. Co., Baltimore, Md.
The Mead Gas Heater Co., Delawanna, N. J.
The A. H. Wolff Gas Radiator Co., 4 Great Jones St., New York, N. Y.

HEATERS (Garage)
Kidde & Co., 169 Chambers St., New York, N. Y.

HEATERS (Pressing and Soldering Irons)
Geo. M. Clark & Co. Div., Chicago, Ill.
Wm. M. Crane Co., 16 W. 32d St., New York, N. Y.
Eclipse Gas Stove Co., Rockford, Ill.
Estate Stove Co., Hamilton, Ohio
General Gas Appliance Co., 103 Park Ave., New York, N. Y.
Strait & Richards, Inc., Newark, N. J.
The Bryant Heater & Mfg. Co., Cleveland, Ohio
The Improved Appliance Co., 419 Kent Ave., Brooklyn, N. Y.

HIGH PRESSURE SYSTEMS
Connelly Iron Sponge & Governor Co., 227 Fulton St., New York, N. Y.
General Fire Extinguisher Co., Providence, R. I.
H. Mueller Mfg. Co., New York, N. Y., and Decatur, Ill.
Selas Co., 521 W. 23d St., New York, N. Y.
The Gas Machinery Co., Cleveland, Ohio
The C. M. Kemp Mfg. Co., Baltimore, Md.
The Surface Combustion Co., 366 Gerard Ave., Bronx, N. Y.

HOT PLATES
A-B Stove Co., Battle Creek, Mich.
Geo. M. Clark & Co. Div., Chicago, Ill.
Wm. M. Crane Co., 16 W. 32d St., New York, N. Y.
Detroit Stove Works, Detroit, Mich.
Eclipse Gas Stove Co., Rockford, Ill.
Eriez Stove & Mfg. Co., Erie, Pa.

General Gas Appliance Co., 103 Park Ave., New York, N. Y.
Rathbone, Sard & Co., Albany, N. Y.
The Baltimore Gas Appliance & Mfg. Co., Baltimore, Md.
The Eclipse Stove Co., Mansfield, Ohio
The Improved Appliance Co., 419 Kent Ave., Brooklyn, N. Y.
The Michigan Stove Co., Detroit, Mich.
The A. H. Wolff Gas Radiator Co., 4 Great Jones St., New York, N. Y.
Union Stove Works, 20 Beekman St., New York, N. Y.
Weir Stove Co., Taunton, Mass.

INCINERATORS
Estate Stove Co., Hamilton, Ohio
Ruud Mfg. Co., Pittsburgh, Pa.

INSTRUMENTS (Measuring, Testing and Recording)
American Meter Co., 105 W. 40th St., New York, N. Y.
Connelly Iron Sponge & Governor Co., 227 Fulton St., New York, N. Y.
Equitable Meter Co., Pittsburgh, Pa.
D. McDonald & Co., Albany, N. Y.
Maryland Meter Works, Baltimore, Md.
Steere Engineering Co., Detroit, Mich.

INSULATING MATERIALS
Celite Products Co., 11 Broadway, New York, N. Y.

KILNS (For Firing Glass, China and Pottery)
B. F. Drakenfeld & Co., Inc., 50 Murray St., New York, N. Y.
General Gas Appliance Co., 103 Park Ave., New York, N. Y.
Russell Engineering Co., St. Louis, Mo.
The Improved Appliance Co., 419 Kent Ave., Brooklyn, N. Y.
The Parker-Russell Mining & Mfg. Co., St. Louis, Mo.
The Surface Combustion Co., 366 Gerard Ave., Bronx, N. Y.

LIGHTERS (Ranges)
Claus Automatic Gas Cock Co., Milwaukee, Wis.
Milwaukee Gas Specialty Co., Milwaukee, Wis.
Safety Gas Lighter Co., Haverhill, Mass.
Strause Gas Iron Co., Philadelphia, Pa.
The Michigan Stove Co., Detroit, Mich.
Welsbach Co., Gloucester, N. J.

LIGHTING (Fixtures)
Will W. Barnes, 31 Chelsea Place, East Orange, N. J.
Shapiro & Aronson, Inc., 20 Warren St., New York, N. Y.
Welsbach Co., Gloucester, N. J.

LIGHTING (Gas Domes, Portables, etc.)
Will W. Barnes, 31 Chelsea Place, East Orange, N. J.
Kramer Bros. Lamp Co., 585 Broadway, New York, N. Y.
Shapiro & Aronson, Inc., 20 Warren St., New York, N. Y.
Welsbach Co., Gloucester, N. J.

LIGHTING (Glassware)
Shapiro & Aronson, Inc., 20 Warren St., New York, N. Y.
Welsbach Co., Gloucester, N. J.

LIGHTING (Incidentals)
Storrs Mica Co., Owego, N. Y.

LIGHTING (Mantles)
General Gas Light Co., New York, N. Y., and Kalamazoo, Mich.
Lindsay Light Co., New York, N. Y., and Chicago, Ill.
Welsbach Co., Gloucester, N. J.

METAL RECEPTACLES
Wm. M. Crane Co., 16 W. 32d St., New York, N. Y.
The Improved Appliance Co., 419 Kent Ave., Brooklyn, N. Y.
The Surface Combustion Co., 366 Gerard Ave., Bronx, N. Y.
United Lead Co., 111 Broadway, New York, N. Y.

METERS
American Meter Co., 105 W. 40th St., New York, N. Y.
Cleveland Gas Meter Co., Cleveland, Ohio
Equitable Meter Co., Pittsburgh, Pa.
John J. Griffin & Co., 1521 Race St., Philadelphia, Pa.
Helme & McIlhenny, 1349 Cherry St., Philadelphia, Pa.
D. McDonald & Co., Albany, N. Y.
Maryland Meter Works, Baltimore, Md.
Metric Metal Works, Erie, Pa.
Rotary Meter Co., 52 Vanderbilt Ave., New York, N. Y.
Superior Meter Co., Bush Terminal, Brooklyn, N. Y.
The Cleveland Rotary Meter Co., Cleveland, Ohio
The Cutler-Hammer Mfg. Co., Milwaukee, Wis.
The Sprague Meter Co., Bridgeport, Conn.
Nathaniel Tufts Meter Works, 455 Commercial St., Boston, Mass.

METER CONNECTIONS, SEALS, Etc.
American Meter Co., 105 W. 40th St., New York, N. Y.
Cleveland Gas Meter Co., Cleveland, Ohio
S. R. Dresser Mfg. Co., Bradford, Pa.
Equitable Meter Co., Pittsburgh, Pa.
Helme & McIlhenny, 1349 Cherry St., Philadelphia, Pa.
D. McDonald & Co., Albany, N. Y.
H. Mueller Mfg. Co., New York, N. Y., and Decatur, Ill.
Superior Meter Co., Bush Terminal, Brooklyn, N. Y.
The Lattimer Stevens Co., Columbus, Ohio
The Sprague Meter Co., Bridgeport, Conn.
Nathaniel Tufts Meter Works, 455 Commercial St., Boston, Mass.

METER PROVERS
American Meter Co., 105 W. 40th St., New York, N. Y.

Equitable Meter Co., Pittsburgh, Pa.
John J. Griffin & Co., Philadelphia, Pa.
Helme & McIlhenny, 1349 Cherry St., Philadelphia, Pa.
D. McDonald & Co. Albany, N. Y.
Maryland Meter Works, Baltimore, Md.
Superior Meter Co., Bush Terminal, Brooklyn, N. Y.
Nathaniel Tufts Meter Works, 455 Commercial St., Boston, Mass.

METER SHELF
Wm. M. Crane Co., 16 W. 32d St., New York, N. Y.

OFFICE LABOR SAVING DEVICES
Addressograph Co., Chicago, Ill.
Burroughs Adding Machine Co., Detroit, Mich.
Elliott-Fisher Co., Harrisburg, Pa.
Kalamazoo Loose-Leaf Binder Co., Kalamazoo, Mich.
Library Bureau, Boston, Mass.
Monroe Calculating Machine Co., Woolworth Bldg., New York, N. Y.
Underwood Typewriter Co., Vesey St., New York, N. Y.

OIL (Diaphragm)
John J. Griffin & Co., 1521 Race St., Philadelphia, Pa.

OVENS (Baking and Cooking)
Geo. M. Clark & Co. Div., Chicago, Ill.
Wm. M. Crane Co., 16 W. 32d St., New York, N. Y.
Eclipse Gas Stove Co., Rockford, Ill.
General Fire Extinguisher Co., Providence, R. I.
General Gas Appliance Co., 103 Park Ave., New York, N. Y.
Meek Oven Mfg. Co., 18 W. 34th St., New York, N. Y.
The G. S. Blodgett Co., Burlington, Vt.
The Crandall-Pettee Co., Hudson St., New York, N. Y.
The Improved Appliance Co., 419 Kent Ave., Brooklyn, N. Y.
The Ohio State Stove & Mfg. Co., Columbus, Ohio
The Union Steel Products Co., Ltd., Albion, Mich.
The Surface Combustion Co., 366 Gerard Ave., Bronx, N. Y.

OVENS (Annealing, Japanning, Drying, Core, etc.)
Gehnrich Indirect Heat Oven Co., Inc., 62 Franklin Ave., Brooklyn, N. Y.
General Fire Extinguisher Co., Providence, R. I.
General Gas Appliance Co., 103 Park Ave., New York, N. Y.
Meek Oven Mfg. Co., 18 W. 34th St., New York, N. Y.
The Improved Appliance Co., 419 Kent Ave., Brooklyn, N. Y.
The C. M. Kemp Mfg. Co., Baltimore, Md.
The Surface Combustion Co., 366 Gerard Ave., New York, N. Y.
The Union Steel Products Co., Ltd., Albion, Mich.
Young Bros. Co., Detroit, Mich.

OVENS (Warming)
Wm. M. Crane Co., 16 W. 32d St., New York, N. Y.
Eclipse Gas Stove Co., Rockford, Ill.
General Gas Appliance Co., 103 Park Ave., New York, N. Y.
Meek Oven Mfg. Co., 18 W. 34th St., New York, N. Y.
The G. S. Blodgett Co., Burlington, Vt.
The Improved Appliance Co., 419 Kent Ave., Brooklyn, N. Y.
The Union Steel Products Co., Ltd., Albion, Mich.

PHOTOMETERS
American Meter Co., 105 W. 40th St., New York, N. Y.
Connelly Iron Sponge & Governor Co., 227 Fulton St., New York, N. Y.
D. McDonald & Co., Albany, N. Y.
Maryland Meter Works, Baltimore, Md.
Nathaniel Tufts Meter Works, Boston, Mass.

PIPE
Camden Iron Works, Camden, N. J.
General Fire Extinguisher Co., Providence, R. I.
National Tube Co., Frick Bldg., Pittsburgh, Pa.
Steere Engineering Co., Detroit, Mich.
The Bartlett Hayward Co., Baltimore, Md.
United Lead Co., 111 Broadway, New York, N. Y.

PIPE CASTINGS AND SPECIALS
Isbell-Porter Co., Newark, N. J.
The Bartlett Hayward Co., Baltimore, Md.
The Stacey Mfg. Co., Cincinnati, Ohio

PIPE CLAMPS AND SLEEVES
S. R. Dresser Mfg. Co., Bradford, Pa.

PIPE PACKING
Celite Products Co., 11 Broadway, New York, N. Y.
General Fire Extinguisher Co., Providence, R. I.
United Lead Co., 111 Broadway, New York, N. Y.

PIPE TOOLS (Caulking, Cutting, Tapping)
General Fire Extinguisher Co., Providence, R. I.
H. Mueller Mfg. Co., New York, N. Y., and Decatur, Ill.
United Lead Co., 111 Broadway, New York, N. Y.

PLATE WARMERS
Wm. M. Crane Co., 16 W. 32d St., New York, N. Y.
Duparquet, Huot & Moneuse Co., 108 W. 22nd St., New York, N. Y.
General Gas Appliance Co., 103 Park Ave., New York, N. Y.

The Improved Appliance Co., 419 Kent Ave., Brooklyn, N. Y.

PORCELAIN ENAMEL PARTS
(Stoves, Lamps, Linings, Stamping and Spinnings)
Baltimore Enamel & Novelty Co., Baltimore, Md.
Eclipse Gas Stove Co., Rockford, Ill.
The Enamel Products Co., Cleveland, Ohio
The Union Steel Products Co., Ltd., Albion, Mich.

PRESSURE GAUGES
American Meter Co., 105 W. 40th St., New York, N. Y.
Connelly Iron Sponge & Governor Co., 227 Fulton St., New York, N. Y.
Equitable Meter Co., Pittsburgh, Pa.
General Fire Extinguisher Co., Providence, R. I.
D. McDonald & Co., Albany, N. Y.
Maryland Meter Works, Baltimore, Md.
Superior Meter Co., Bush Terminal, Brooklyn, N. Y.
The Bryant Heater & Mfg. Co., Cleveland, Ohio
The Cleveland Rotary Meter Co., Cleveland, Ohio.
The Gas Machinery Co., Cleveland, Ohio
Nathaniel Tufts Meter Works, Boston, Mass.

PUMPS
American Meter Co., 105 W. 40th St., New York, N. Y.
Gas Machinery Co., Cleveland, Ohio
Nathaniel Tufts Meter Works, Boston, Mass.
Plant Engineering & Equipment Co., Inc., 192 Broadway, New York, N. Y.

PURIFIERS
Camden Iron Works, Camden, N. J.
Connelly Iron Sponge & Governor Co., 227 Fulton St., New York, N. Y.
Cruse-Kemper Co., Ambler, Pa.
Gas Machinery Co., Cleveland, Ohio
Isbell-Porter Co., Newark, N. J.
Steere Engineering Co., Detroit, Mich.
The Bartlett Hayward Co., Baltimore, Md.
The Improved Equipment Co., 60 Wall St., New York, N. Y.
The Stacey Bros. Gas Construction Co., Cincinnati, Ohio
The Stacey Mfg. Co., Cincinnati, Ohio

PURIFYING MATERIALS
Connelly Iron Sponge & Governor Co., 227 Fulton St., New York, N. Y.

RADIATORS
James B. Clow & Sons, Chicago, Ill.
Wm. M. Crane Co., 16 W. 32d St., New York, N. Y.
Eriez Stove & Mfg. Co., Erie, Pa.
General Fire Extinguisher Co., Providence, R. I.
Kidde & Co., 169 Chambers St., New York, N. Y.
The Improved Appliance Co., 419 Kent Ave., Brooklyn, N. Y.
The Mead Gas Heater Co., Delawanna, N. J.
The A. H. Wolff Gas Radiator Co., 4 Great Jones St., New York, N. Y.

RANGES (Domestic)
A-B Stove Co., Battle Creek, Mich.
Geo. M. Clark & Co. Div., Chicago, Ill.
Bartlett & Co., Inc., Philadelphia, Pa.
Comstock-Castle Stove Co., Quincy, Ill.
Abram Cox Stove Co., Philadelphia, Pa.
Wm. M. Crane Co., 16 W. 32d St., New York, N. Y.
Detroit Stove Works, Detroit, Mich.
Eclipse Gas Stove Co., Rockford, Ill.
Eriez Stove & Mfg. Co., Erie, Pa.
Estate Stove Co., Hamilton, Ohio
New Process Stove Co. Div., Cleveland, Ohio.
Rathbone, Sard & Co., Albany, N. Y.
Reliable Stove Co. Div., Cleveland, O.
Roberts & Mander Stove Co., Philadelphia. Pa.
The Baltimore Gas Appliance & Mfg. Co., Baltimore, Md.
The Eclipse Stove Co., Mansfield, Ohio
The General Gas Appliance Co., 103 Park Ave., New York, N. Y.
The Michigan Stove Co., Detroit, Mich.
The Ohio State Stove & Mfg. Co., Columbus, Ohio
The Peninsular Stove Co., Detroit, Mich.
The A. H. Wolff Gas Radiator Co., 4 Great Jones St., New York, N. Y.
Union Stove Works, 70 Beekman St., New York, N. Y.
Vesta Gas Range & Mfg. Co., Chattanooga, Tenn.
Weir Stove Co., Taunton, Mass.

RANGES (Hotel)
Geo. M. Clark & Co. Div., Chicago, Ill.
Comstock-Castle Stove Co., Quincy, Ill.
Abram Cox Stove Co., Philadelphia, Pa.
Wm. M. Crane Co., 16 W. 32d St., New York, N. Y.
Detroit Stove Works, Detroit, Mich.
Duparquet, Huot & Moneuse Co., 108 W. 22nd St., New York, N. Y.
Eclipse Gas Stove Co., Rockford, Ill.
Estate Stove Co., Hamilton, Ohio
The General Gas Appliance Co., 103 Park Ave., New York, N. Y.
Roberts & Mander Stove Co., Philadelphia, Pa.
The Baltimore Gas Appliance & Mfg. Co., Baltimore, Md.
The Michigan Stove Co., Detroit, Mich.

REFRACTORY MATERIALS
Harbison-Walker Refractories Co., Pittsburgh, Pa.
Russell Engineering Co., St. Louis, Mo.
Tate-Jones & Co., Inc., 50 Church St., New York, N. Y.
The Improved Equipment Co., 60 Wall St., New York, N. Y.
The Parker-Russell Mining & Mfg. Co., St. Louis, Mo.

REGULATORS (Governors)
- American Meter Co., 105 W. 40th St., New York, N. Y.
- Connelly Iron Sponge & Governor Co., 227 Fulton St., New York, N. Y.
- Equitable Meter Co., Pittsburgh, Pa.
- Gas Machinery Co., Cleveland, Ohio
- Isbell-Porter Co., Newark, N. J.
- H. Mueller Mfg. Co., New York, N. Y., and Decatur, Ill.
- Reynolds Gas Regulator Co., Anderson, Ind.
- Steere Engineering Co., Detroit, Mich.
- The Improved Equipment Co., 60 Wall St., New York, N. Y.
- The Cleveland Rotary Meter Co., Cleveland, Ohio
- The Sprague Meter Co., Bridgeport, Conn.

REPAIRS (Gas Meters and Appliances)
- Helme & McIlhenny, 1349 Cherry St., Philadelphia, Pa.
- Maryland Meter Works, Baltimore, Md.

RETORTS
- Gas Machinery Co., Cleveland, Ohio
- Harbison-Walker Refractories Co., Pittsburgh, Pa.
- Russell Engineering Co., St. Louis, Mo.
- The Improved Equipment Co., 60 Wall St., New York, N. Y.
- The Parker-Russell Mining & Mfg. Co., St. Louis, Mo.

RUST PREVENTATIVE
- Superior Laboratories, Grand Rapids, Mich.

SCRUBBERS
- Camden Iron Works, Camden, N. J.
- Gas Machinery Co., Cleveland, Ohio
- Isbell-Porter Co., Newark, N. J.
- Steere Engineering Co., Detroit, Mich.
- The Bartlett Hayward Co., Baltimore, Md.
- The Improved Equipment Co., 60 Wall St., New York, N. Y.
- The Koppers Co., Pittsburgh, Pa.
- The Stacey Bros. Gas Construction Co., Cincinnati, Ohio
- The Stacey Mfg. Co., Cincinnati, Ohio

SERVICE BOXES, CLAMPS, Etc.
- Camden Iron Works, Camden, N. J.
- General Fire Extinguisher Co., Providence, R. I.
- Hays Mfg. Co., Inc., Erie, Pa.
- H. Mueller Mfg. Co., New York, N. Y., and Decatur, Ill.

STILLS (Benzol, Toluol)
- The Bartlett Hayward Co., Baltimore, Md.
- The Koppers Co., Pittsburgh, Pa.
- The Walter E. Lummus Co., Boston, Mass.

STOVES (Confectioners, Laundry, Tailor)
- A-B Stove Co., Battle Creek, Mich.
- Geo. M. Clark & Co. Div., Chicago, Ill.
- Wm. M. Crane Co., 16 W. 32d St., New York, N. Y.
- The General Gas Appliance Co., 103 Park Ave., New York, N. Y.
- The Improved Appliance Co., 419 Kent Ave., Brooklyn, N. Y.

STRAINERS—STEAM TRAPS
- Plant Engineering & Equipment Co., Inc., 192 Broadway, New York, N. Y.

STRUCTURAL STEEL WORKS (Holders, etc.)
- Camden Iron Works, Camden, N. J.
- Cruse-Kemper Co., Ambler, Pa.
- The Bartlett Hayward Co., Baltimore, Md.
- The Stacey Bros. Gas Construction Co., Cincinnati, Ohio
- The Stacey Mfg. Co., Cincinnati, Ohio

TANKS (Ammonia, Oil, Water)
- Camden Iron Works, Camden, N. J.
- Cruse-Kemper Co., Ambler, Pa.
- Gas Machinery Co., Cleveland, Ohio
- National Tube Co., Frick Bldg., Pittsburgh, Pa.
- Steere Engineering Co., Detroit, Mich.
- The Bartlett Hayward Co., Baltimore, Md.
- The Improved Appliance Co., 419 Kent Ave., Brooklyn, N. Y.
- The Stacey Bros. Gas Construction Co., Cincinnati, Ohio
- The Stacey Mfg. Co., Cincinnati, Ohio

THERMOMETERS
- American Meter Co., 105 W. 40th St., New York, N. Y.
- Connelly Iron Sponge & Governor Co., 227 Fulton St., New York, N. Y.
- Gas Machinery Co., Cleveland, Ohio
- General Fire Extinguisher Co., Providence, R. I.
- Improved Appliance Co., 419 Kent Ave., Brooklyn, N. Y.

THERMOSTATS
- Gas Machinery Co., Cleveland, Ohio
- Kidde & Co., 169 Chambers St., New York, N. Y.
- Minneapolis Heat Regulator Co., Minneapolis, Minn.
- B. Ryan & Co., 60 E. 10th St., New York, N. Y.
- The Bryant Heater & Mfg. Co., Cleveland, Ohio

THERMO VALVES
- Pittsburgh Water Heater Co., Pittsburgh, Pa.

THORIUM
- Welsbach Co., Gloucester, N. J.

TRENCH WORK
- Connelly Iron Sponge & Governor Co., 227 Fulton St., New York, N. Y.

VALVES
- Claus Automatic Gas Cock Co., Milwaukee, Wis.

Connelly Iron Sponge & Governor Co., 227 Fulton St., New York, N. Y.
Gas Machinery Co., Cleveland, Ohio
General Fire Extinguisher Co., Providence, R. I.
Isbell-Porter Co., Newark, N. J.
Plant Engineering & Equipment Co., Inc., 192 Broadway, New York, N. Y.
Steere Engineering Co., Detroit, Mich.
The Bartlett Hayward Co., Baltimore, Md.
The Bryant Heater & Mfg. Co., Cleveland, Ohio
The Improved Appliance Co., 419 Kent Ave., Brooklyn, N. Y.
The Improved Equipment Co., 60 Wall St., New York, N. Y.
The Stacey Mfg. Co., Cincinnati, Ohio

WATER HEATERS

A-B Stove Co., Battle Creek, Mich.
Bartlett & Co., Inc., Philadelphia, Pa.
Geo. M. Clark & Co. Div., Chicago, Ill.
Abram Cox Stove Co., Philadelphia, Pa.
Wm. M. Crane Co., 16 W. 32d St., New York, N. Y.
Detroit Stove Works, Detroit, Mich.
Eclipse Gas Stove Co., Rockford, Ill.
Estate Stove Co., Hamilton, Ohio
General Gas Appliance Co., 103 Park Ave., New York, N. Y.
Humphrey Co., Kalamazoo, Mich.
Kidde & Co., 169 Chambers St., New York, N. Y.
Lawson Mfg. Co., Pittsburgh, Pa.
Long-Landreth-Schneider & Co., New Brunswick, N. J.
New Process Stove Co. Div., Cleveland, Ohio.
Peninsular Stove Co., Detroit, Mich.
Philadelphia Stove Co., Philadelphia, Pa.
Pittsburgh Water Heater Co., Pittsburgh, Pa.
Rathbone, Sard & Co., Albany, N. Y.
Reliable Stove Co. Div., Cleveland, O.
Ruud Mfg. Co., Pittsburgh, Pa.
The Baltimore Gas Appliance & Mfg. Co., Baltimore, Md.
The Bryant Heater & Mfg. Co., Cleveland, Ohio
The Cleveland Heater Co., Cleveland, Ohio
The Hoffman Heater Co., Lorain, Ohio
The Michigan Stove Co., Detroit, Mich.

WATER STILLS (Gas Heated)

The Improved Appliance Co., 419 Kent Ave., Brooklyn, N. Y.
Young Bros Co., Detroit, Mich.

WELDED STEEL PIPE

The Bartlett Hayward Co., Baltimore, Md.
Steere Engineering Co., Detroit, Mich.

REDUCTION OF RADIATION LOSSES

Extract from Remarks by J. W. Richards, Professor of Metallurgy, Lehigh University
(Reprinted from *The Iron Age*, May 29, 1919.)

Iron and steel men do not pay a fraction of the attention which they should to reduction of radiation losses from furnaces and very hot apparatus. They paint surfaces black, the best color to radiate heat, when they should be painted white. They smile the sarcastic smile of contented ignorance when it is suggested to them that heat losses can be largely diminished by proper attention to the radiation surface. Tell a foundryman that heat could be saved in sufficient quantity to pay well if he had the outside of his furnaces nickelplated and kept them bright, and he would probably regard his informer as demented. Yet in many cases the statement would be true and doubly true of electric furnaces.

I strongly urge the use of white aluminum paint as one step in reducing radiation losses on furnaces. Some of our laboratory furnaces are encased in polished Monell metal; it would undoubtedly be well to encase steel works electric furnaces in this manner. Even bright nickelplating of ordinary iron shells would in most cases pay for itself in heat saved in a short time.

(Continued from page 450.)

And with 85 to 90 per cent. of the cost of the average finished product (going back through all the various materials required to produce it until you get to the iron ore, coal, etc.) represented by labor, how can there be a price slump?

Educate your salesmen to this view point (extra copies of this bulletin may be had on request) and have them in turn educate their trade.

The answer will be big business and prosperity for every one, even though prices are high.

As Prof. Irving Fisher has said, we are on a permanently higher level of prices, so let's go ahead and make the most of it.

BIBLIOGRAPHY OF GAS LITERATURE

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Gas Industry—The Periodicals Publishing Co., Inc. (Buffalo, N. Y.).

Gas Record (20 W. Jackson Blvd., Chicago, Ill.).

Int. G. Jour. of Canada—Intercolonial Gas Journal of Canada (90 Caroline St., N. Hamilton, Canada).

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Natural Gas and Gasoline Journal—The Periodicals Publishing Co., Inc. (Buffalo, N. Y.).

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Gas Jour.—Gas Journal (Walter King, Publisher, 11 Bolt Court, Fleet St., London, E. C.).

The Gas World (John Allen & Co., 8 Bouverie St., London, E. C. 4).

Association Bulletins.

Bulletin B. C. G. A.—British Commercial Gas Association (47 Victoria St., Westminster, London, S. W.).

Bulletin Empire State Gas & Electric Association (29 W. 39th St., New York, N. Y.).

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Jour. R. Soc. of Arts—Journal of the Royal Society of Arts (John St., Adelphi, London, W. C. 2).

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Pacific Service Magazine (Pacific Gas & Electric Co., San Francisco, Cal.).

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American Chemical Exposition Gas Appliance Exhibition (Chicago, Sept. 22-28)		Am. G. E. Jour., July 12, 33
American Gas Association Advertising Section		Gas Age, July 1, 27 Gas Industry, July. 176 A. G. A. Monthly, July, 369 Gas Record, July 9, 21
Manufacturers Section		Gas Industry, July, 186, 197 Gas Record, July 9, 25
Nominating Committees		A. G. A. Monthly, July, 380
B. C. G. A. Conference—Edinburgh		Gas Jour., June 17, 748 Gas World, June 21, 541
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B. C. G. A. Meeting, June 23		Gas World, June 28, 549 Gas Jour., July 1, 18
Canadian Gas Association Aug. 21-22, 1919		A. G. A. Monthly, July, 388
Gas Sales Association. Annual Meeting (Boston, May 9)		Am. G. E. Jour., June 28, 560
Iowa District Gas Association (Lincoln, Neb., May 21-22)		Gas Industry, July, 187
Institution of Gas Engineers Editorial on President's Address		Gas Age, July 1, 19
Natural Gas and Petroleum Assn. of Canada (London, Ont.)		Gas Jour. of Can., July. 247
Natural Gas Association of Am.—Committees		Gas Age, July 15, 71

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Alcohol Production for Power		Chem. Age, July 5, 66
Ammonia Sulphate Sales		Gas Jour., June 17, 763
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Coke Conveyor—New Idea		Am. G. E. Jour., July 12, 35
Coke, Present is Time to Buy (I. D. G. A. paper)	H. G. Stillson	Am. G. E. Jour., July 12, 26
Coke, Selling Domestic Gas	C. J. Hauschild J. A. Galligan G. H. Mace	Gas Age, July 1, 9 Gas Age, July 1, 10 Gas Age, July 1, 14 Am. G. E. Jour., July 5, 8
Coke Utilization in Europe	A. W. H. Griepe	Gas Age, July 15, 61 Gas World, July 5, C. S. 15
Cyanogen, Recovery of	Dr. W. Berletsmann	Gas World, June 14, 517
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Light Oil Stills, Dehydrators for Crude Tar (I. D. G. A. paper)	H. C. Adams	Am. G. E. Jour., July 5, 6 Gas Record, July 9, 31
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Phenol in Tar Oils	G. C. Petrie	Gas Jour., June 24, 803
Recovery Plants, Scrapping of	Editorial	Am. G. E. Jour., July 12, 32
Sulphuric Acid Plants		Gas World, July 5, C. S. 12
Sulphuric Acid Works, Cost Systems in	H. J. Bush	Chem. Age, July 5, 58
TNT for Industrial Blasting		Gas Record, July 9, 21

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Complaint and Trouble Service, Charging for	C. A. Nash	Am. G. E. Jour., June 28, 556, 557 Gas Industry, July, 191

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Explosion Caused by Leaking Holder		Am. G. E. Jour., July 5, 16
Flexible Gas Tubing Tests (Technologic paper No. 133)	R. S. McBride W. M. Berry	Gas Record, June 25, 393
Gas Flow Meters	A. F. Benton	Ind. & Eng. Chemistry, July, 623
Holder Cleaned When Full	A. H. Harris, Jr.	Am. G. E. Jour., June 21, 526
Main, Repairing Broken Gas	C. C. Bahr	Gas Age, July 15, 54
Mains Welded by Oxy-Acetylene (N. E. Gas Assn. reports)		Acet. Jour., July, 30
Meter Reading and Billing	R. E. Phillips	Gas Industry, July, 190
Meter Repairing	J. H. Schalek	Gas Record, June 25, 404
Motor Trucks—Des Moines, Iowa	D. P. Allen	Gas Record, June 25, 413
Pipe Welding		Gas Industry, July, 196
Prepayment Meters in England		Am. G. E. Jour., July 12, 29 Gas Age, July 15, 56
Pressure Mains Provide for Increasing Load	S. C. Singer	Gas Industry, July, 195 Am. G. E. Jour., July 5, 7

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Daylight Saving, Fuel Saved		Am. G. E. Jour., June 21, 534
Depreciation, Theoretical	G. N. Webster	N. E. L. A. Bul., June, 313
Distribution and Extensions, Financial Considerations (I. D. G. A. paper)	W. J. Bertke	Am. G. E. Jour., July 12, 27 Gas Industry, July, 193
"Fields Analysis" Jubilee		Gas Jour., July 1, 17
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Public Utility Credit		Am. G. E. Jour., July 12, 32
Regulation Checks Initiative	S. Insull	Gas Record, July 9, 23
Utility Costs in Europe and United States Compared		Am. G. E. Jour., June 21, 534

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Accident Prevention	C. B. Scott	N. E. L. A. Bul., June, 310 A. G. A. Monthly, July, 387
Beal Medal		A. G. A. Monthly, July, 381
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Cohn, Chas. M., Elected President Industrial Corporation		Gas Age, July 1, 25
Conserving Natural Gas	A. J. Deischer J. C. Dickerman E. C. Jennings	Am. G. E. Jour., June 21, 559 Gas Record, June 25, 410 Gas Age, July 15, 20; 70
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Natural Gas, Depletion of (Appalachian Field)		Gas Age, July 15, 57
Natural Gas, Discriminatory Restriction Illegal		Gas Age, July 15, 60
Natural Gas Distribution (Virginia Case)		Gas Age, July 1, 29
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LEGISLATION AND COMMISSION CONTROL.		
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Competition, Restricting		Gas Age, July 1, 1
Penalty for Low Pressure in Extreme Weather (Dayton, O.)		Gas Age, July 1, 23
Power to Change Franchise Rates Given Commission (Okla.)		Am. G. E. Jour., July 5, 16 Gas Age, July 1, 17 Am. G. E. Jour., July 5, 6
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Rate Decisions, Recent (Yuma, Tucson, Ariz.; Bismarck, N. D.)		Gas Age, July 1, 6
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State Utilities Commission Stands in Illinois		Am. G. E. Jour., June 21, 538
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Gas Furnace Development	M. Meredith	Gas Age, July 15, 84
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Exploitation of Domestic Gas	A. W. Borden	Am. G. E. Jour., July 5, 5
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Housing Schemes, Gas in	H. Masterson H. H. Creasey	Gas Jour., June 17, 749 Gas Jour., July 1, 35
Incubator Field for Gas	G. C. Shadwell	Am. G. E. Jour., July 5, 1
Industrial Gas Possibilities	H. O. Loebell G. W. Allen L. W. Alwyn-Schmidt	Gas Age, July 1, 37 Gas Age, July 1, 38 Am. G. E. Jour., July 12, 21
Industrial Lighting	C. E. Clewell	Jour. Frank. Inst., July, 5
Industrial Lighting Codes	G. H. Stickney	Trans. I. E. S., June 10, 153
Industrial Uses for Gas		Am. G. E. Jour., July 12, 33-37
Inverted Mantle—Effected by Heat Regeneration	J. S. G. Thomas	Gas Jour., July 8, 77
Light and Color in Stage Effects		Jour. R. Soc. of Arts, June 27, 527
Lighting Ships with Gas		Pac. Ser. Mag., June, 11
Pens, Gas in Manufacture of	G. C. Shadwell	Am. G. E. Jour., July 12, 24
Producer Gas as Fuel	E. E. Adams	Gas Age, July 1, 36
Radiant Heat, New Facts	J. P. Conroy	Gas Record, July 9, 45
Rivet Heating with Gas		Am. G. E. Jour., July 12, 41
Space Heating, Largest Gas Installation		Am. G. E. Jour., July 19, 48
Street Lighting, Board of Public Works Approves Gas (Indiana)		Am. G. E. Jour., June 28, 562

ARTICLE	AUTHOR	PUBLICATION
Street Lighting Reformation		Gas World, June 28, 255 Gas Jour., July 1, 15, 29
Theatre Installs Gas		Am. G. E. Jour., June 21, 540
Washing Machines, Gas Heated		Adv. Club News, July 15, 1
Water Heater, Novel		Gas World, June 8, 556

AMERICAN GAS ASSOCIATION, Inc.

List No. 31—August, 1919.

Rate Increases Secured.

Where information is not secured from company receiving increase, the source of information is noted in brackets. See Cumulative List of February 5, 1919, for explanation of abbrevations. This list includes only increases reported as secured subsequent to February 5, 1919.

INDIANA.

Alexandria: Central Indiana Gas Co. reports rate for artificial gas succeeding mixed gas. Net rates: 1st 2 MCF 90¢—next 3 MCF 80¢—next 45 MCF 70¢—next 50 MCF 65¢—all over 100 MCF 60¢ per M. M. M. Chge. 90¢ per month. Effective March 1, 1919, to Nov. 30, 1919.

Elwood: Central Indiana Gas Co. reports rates established by P. S. C., effective March 1, 1919, which apply also to Alexandria. Both companies formerly supplied mixed gas now supplying manufactured gas. 1st 2 MCF $1.00 gross per M, 90¢ net—next 3 MCF 90¢ gross, 80¢ net—next 45 MCF 70¢ net—next 50 MCF 65¢ net—over 100 MCF 60¢ net. M. M. Chge. 90¢ per month.

Marion: Same as Anderson. Current List No. 30.

MAINE.

Portland: Gas Light Co. reports under date of June 19, 1919, the P. S. C. allowed a continuance of the foregoing increased rate for one year from Aug. 1, 1919, subject to revision if necessary before the expiration of that period.

MASSACHUSETTS.

East Boston: Gas Co. reports: Old rate 90¢ per MCF. New rate effective May 1, 1919, $1.00 per MCF. Also supplies Chelsea.

Hyde Park: Dedham & Hyde Park G. & E. Co. reports old rate: 1st 3 MCF $1.20 net—next 30 MCF $1.15—next 100 MCF $1.10—over 100 MCF $1.05 per M. New net rates effective June 1, 1919: 1st 3 MCF $1.25—next 30 MCF $1.20—next 100 MCF $1.15—over 100 MCF $1.10 per M. M. M. Chge. 50¢ per M.

Newton: Newton & Watertown Gas Lt. Co. reports: Old rate 95¢ per M. New rate effective May 1, 1919, $1.00 per MCF.

Worcester: Gas Light Co. reports the order to reduce the price to $1.10 per M was reconsidered and another order, June 18, 1919, entered, establishing the rate still in force to remain until March 1, 1920. New rate: 1st 25 MCF $1.15 net—next 25 MCF $1.10—next 50 MCF $1.05—over 100 MCF $1.00 net per M.

MICHIGAN.

Cadillac: Gas Light Co. reports second increase. New rate: $1.65 gross, $1.50 net per MCF.

NEW YORK.

Corning: Crystal City Gas Co. reports second increase from 58¢ gross per MCF to 65¢ gross, 58¢ net per M (natural).

Saratoga Springs: Adirondack Elec. Power Co. reports: Old rate, $1.45 gross, $1.35 net per MCF. New rate effective Aug. 15, 1918: 1st 25 MCF $1.70 per M—over 25 MCF $1.50 per M. 10¢ discount 10 days. M. M. Chge. 58¢.

OREGON.

Medford: Oregon Gas & Elec. Co. reports second increase effective April 1, 1919. New rate: 1st 200 c. f. or less \$1.05—next 4,800 c. f. \$2.10 per M—all over 5 MCF \$1.75 per M. Discount, 5% 10 days. Applies also to Ashland, Grants Pass and Roseburg, Oregon.

TENNESSEE.

Nashville: Nashville Gas & Heating Co. reports: Old rate \$1.10 gross, \$1.00 net per MCF. New rate effective July 1, 1919: \$1.20 gross, \$1.10 net per MCF. M. S. Chge. 50¢ per meter. M. M. Chge. 50¢ per month exclusive of service charge. Company reports this the first rate increase granted by P. S. C. in state.

WASHINGTON.

Centralia: Northern Pacific Public Service Co. reports increase effective June 8, 1919. Old rate: 100 cu. ft. or less 75¢—200 cu. ft. 80¢—300 cu. ft. 85¢—400 cu. ft. 90¢—500 cu. ft. \$1.05—600 cu. ft. \$1.25—700 cu. ft. \$1.40—800 cu. ft. \$1.55—900 cu. ft. \$1.70— 1,000 cu. ft. \$1.85—discount 5¢ each block. Next 4 MCF \$1.70 per M—next 5 MCF \$1.60—next 5 MCF \$1.50—over 15 MCF 85¢, discount 5¢ per M. New rate: 1st 300 cu. ft. or less \$1.00 net—400 cu. ft. \$1.05—500 cu. ft. \$1.15—600 cu. ft. \$1.35—700 cu. ft. \$1.55—800 cu. ft. \$1.75—900 cu. ft. \$1.90. 1 MCF \$2.05—discount 5¢ each block—next 4 MCF \$1.85 per M—next 5 MCF \$1.60—next 5 MCF \$1.50—all over 15 MCF 85¢ per M—discount 5¢ per M. P. P. meters 0 to 2 MCF \$2.25 net per M—over 2 MCF \$1.85 per M.

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July 1-31, 1919, Inclusive.

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